CHNOLOGY DEPT.

Gas Journal

VOL. 290. 109th YEAR. LONDON, JUNE 26, 1957. No. 3[illegible]2 PRICE 1/6

DETROIT

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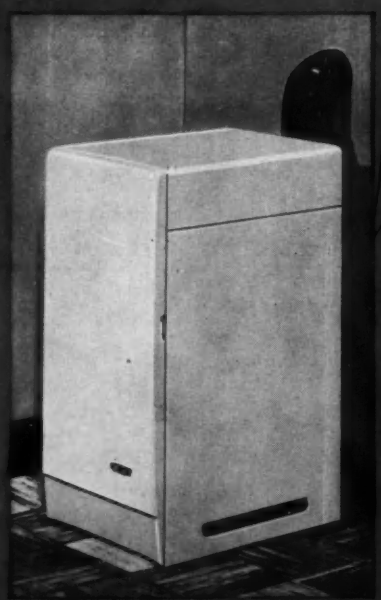
£50

a whole year's central heating for less than £50*



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'Potterton'

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for central heating and hot water

MODELS OF SELF-CONTROL

in a post-war three-bedroomed house

These figures are for an earlier 25,000 B.t.u/hr. 'Potterton' boiler during the period October 1955 to October 1956, with gas at 1/4½ a therm. They surely prove that there is a ready market for the highly efficient gas-fired boiler in the average house. This particular house is cavity-walled, insulated between rafters in the roof space and fitted with plate glass windows. The eight radiators have a total radiating surface of 165 sq. ft. Two factors contribute to these low running costs — the high efficiency of the 'Potterton' boiler and the accurate controls with which it is fitted. Of particular importance is the clock control which switches off the boiler for a specified period during the night and the day. There can be no doubt that many householders are keen to install a boiler which looks after itself and which does away once and for all with problems of fuel supply. They are in fact waiting to be shown a 'Potterton' boiler — the *automatic* choice. It is not expensive in first cost and it is simple to install. But, above all, it can cost far less to run — especially under the new tariffs in some areas — than many people imagine.

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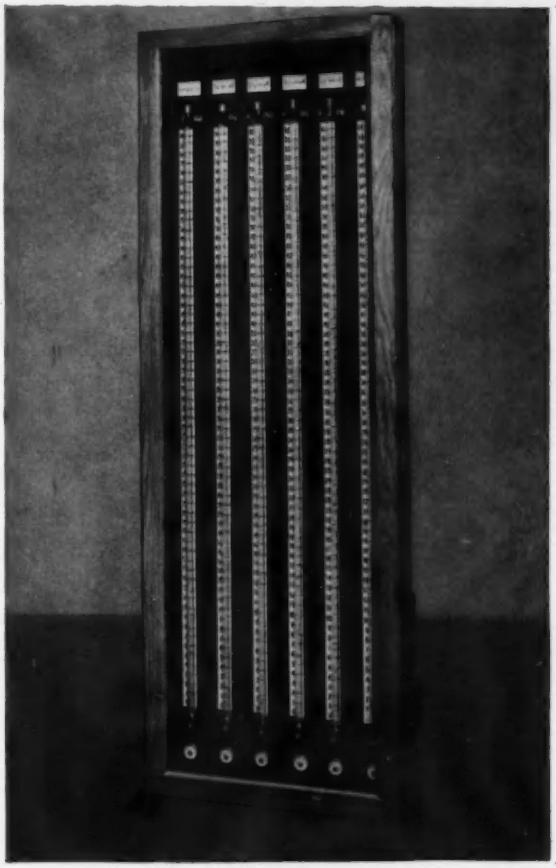

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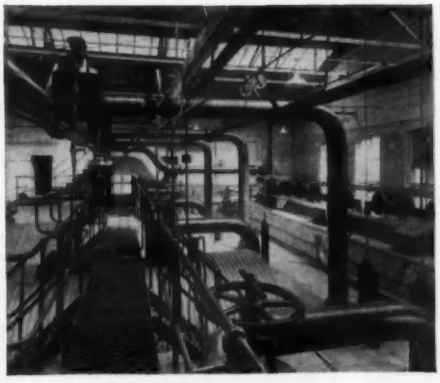

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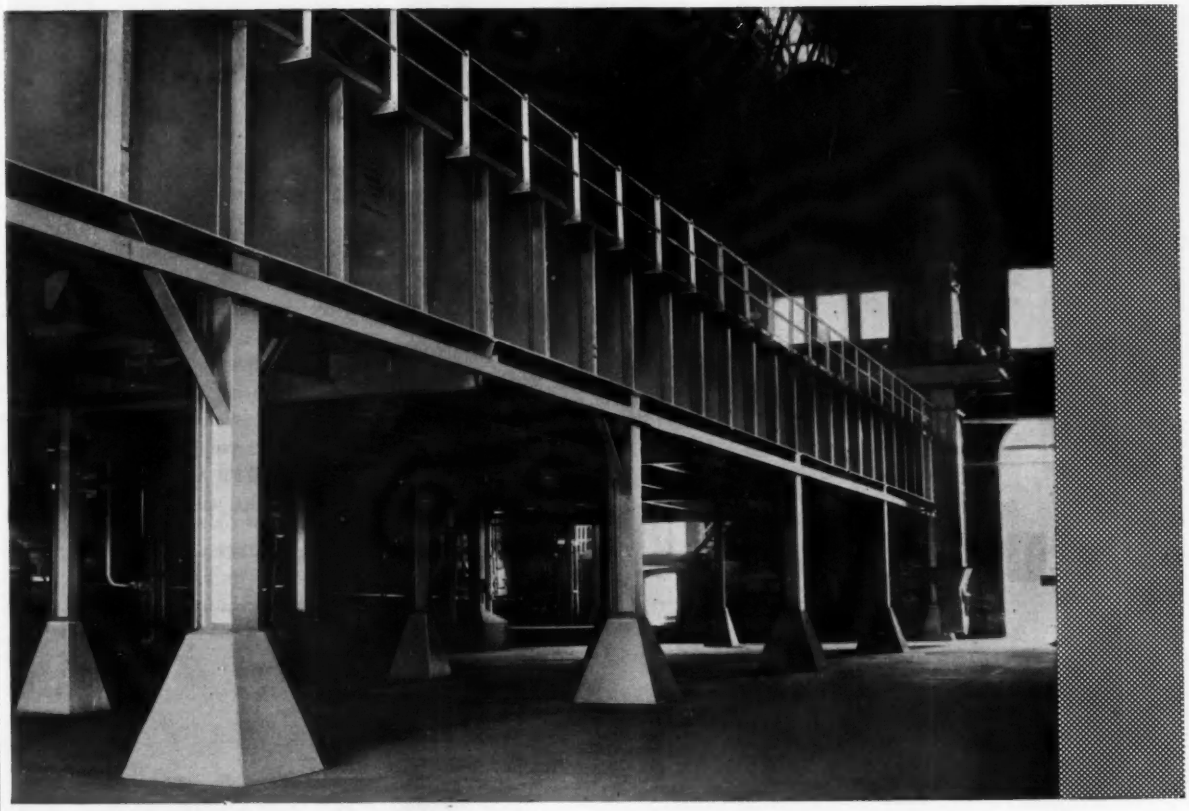

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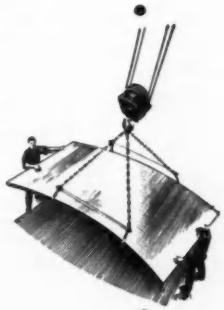

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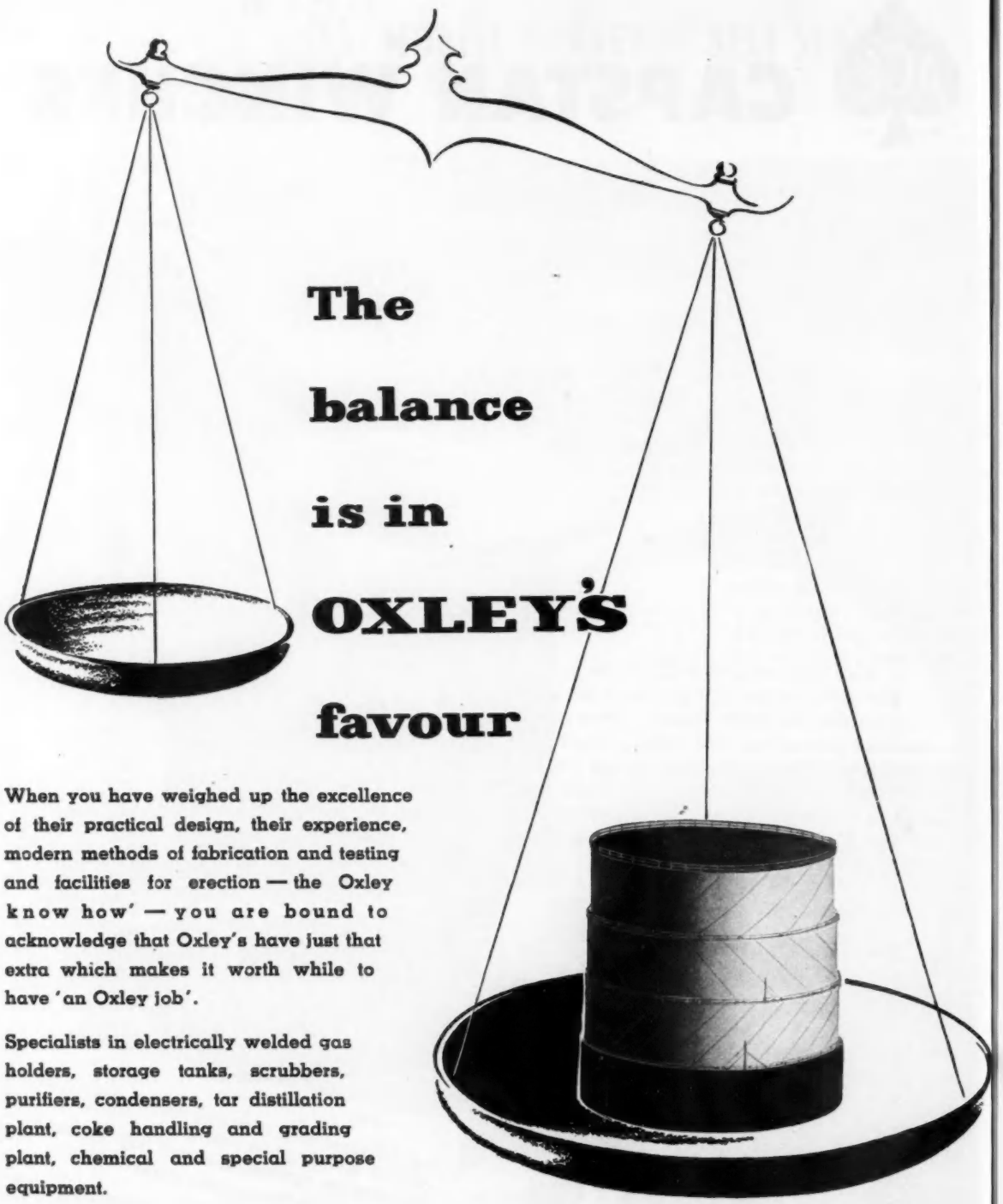

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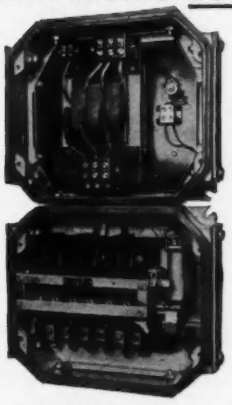

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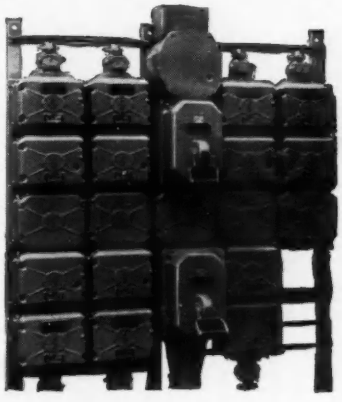

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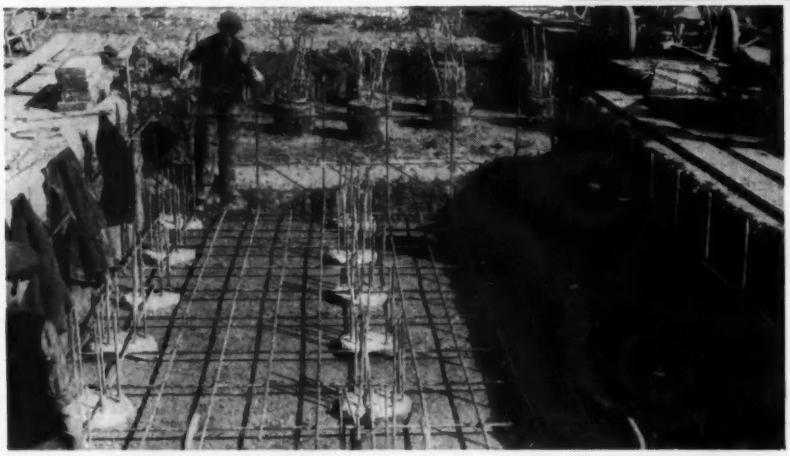

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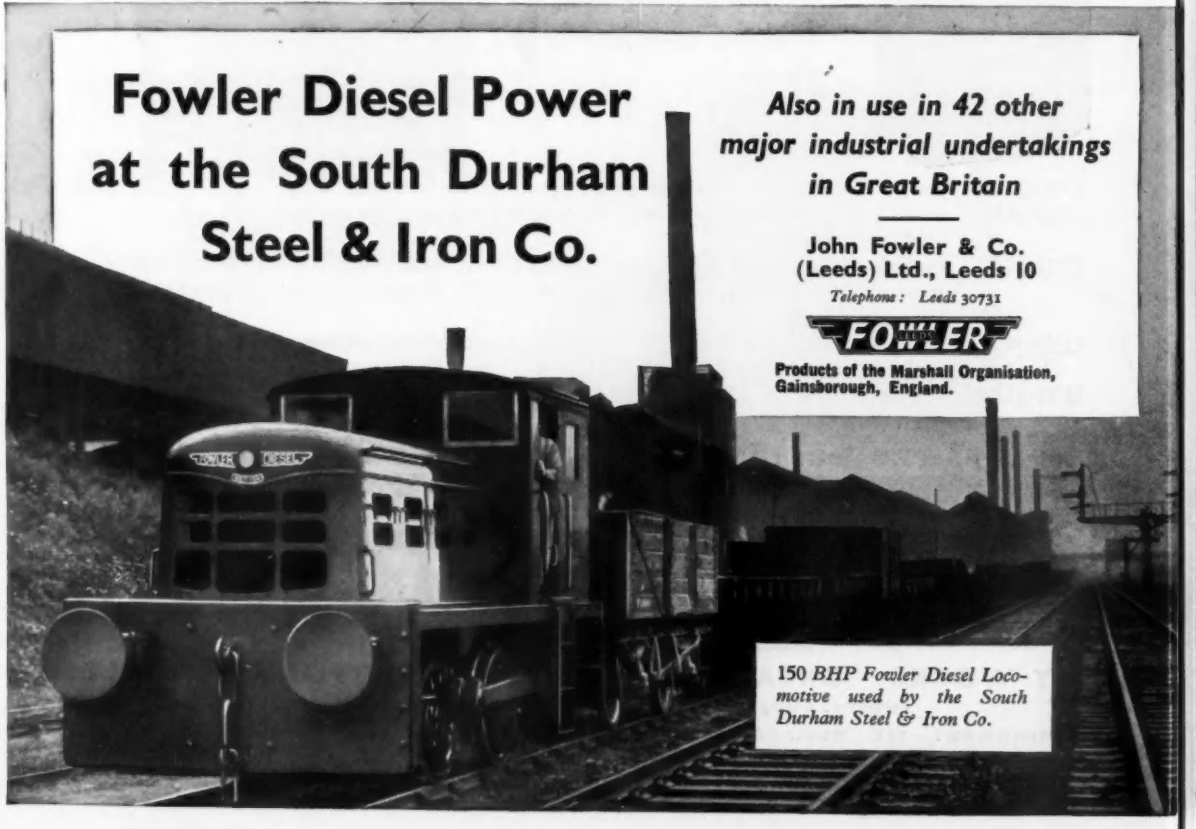
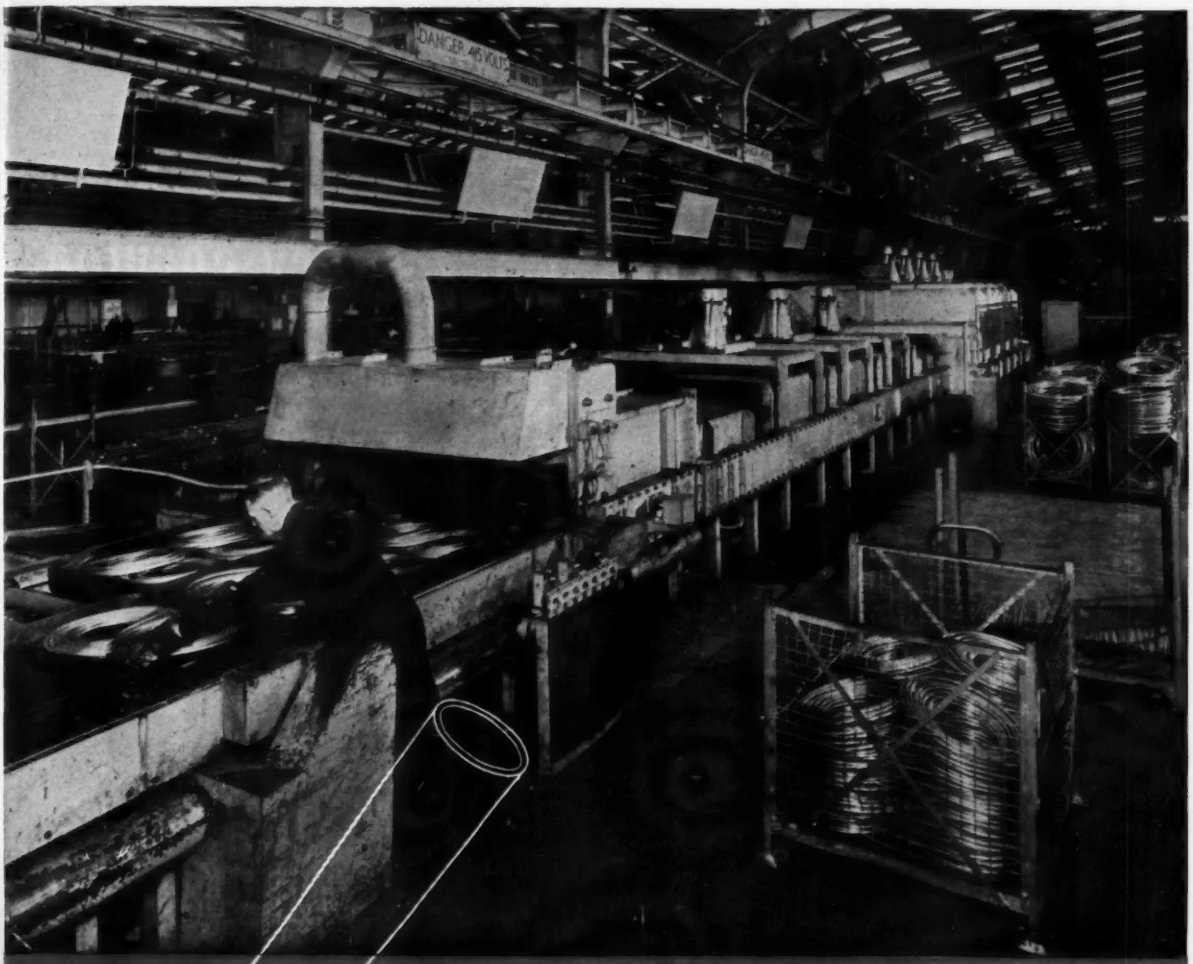


150 *BHP Fowler Diesel Locomotive used by the South Durham Steel & Iron Co.*



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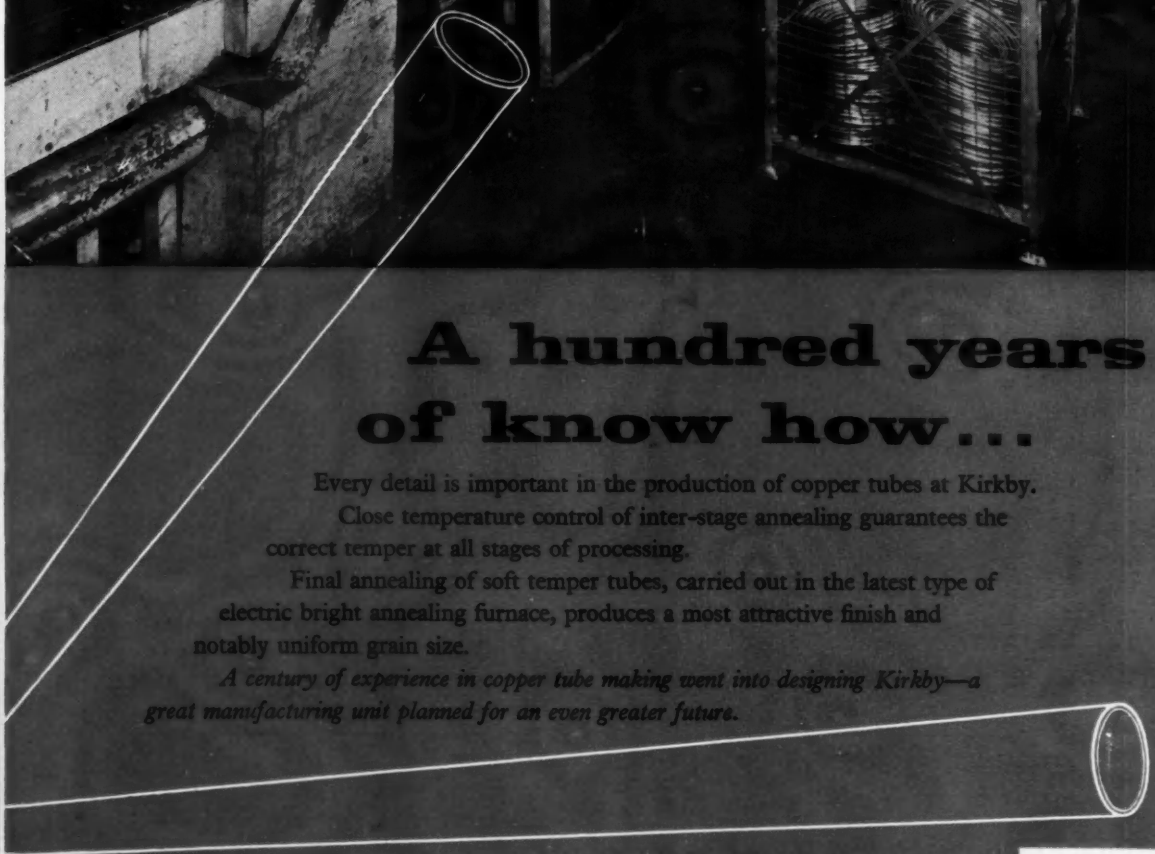

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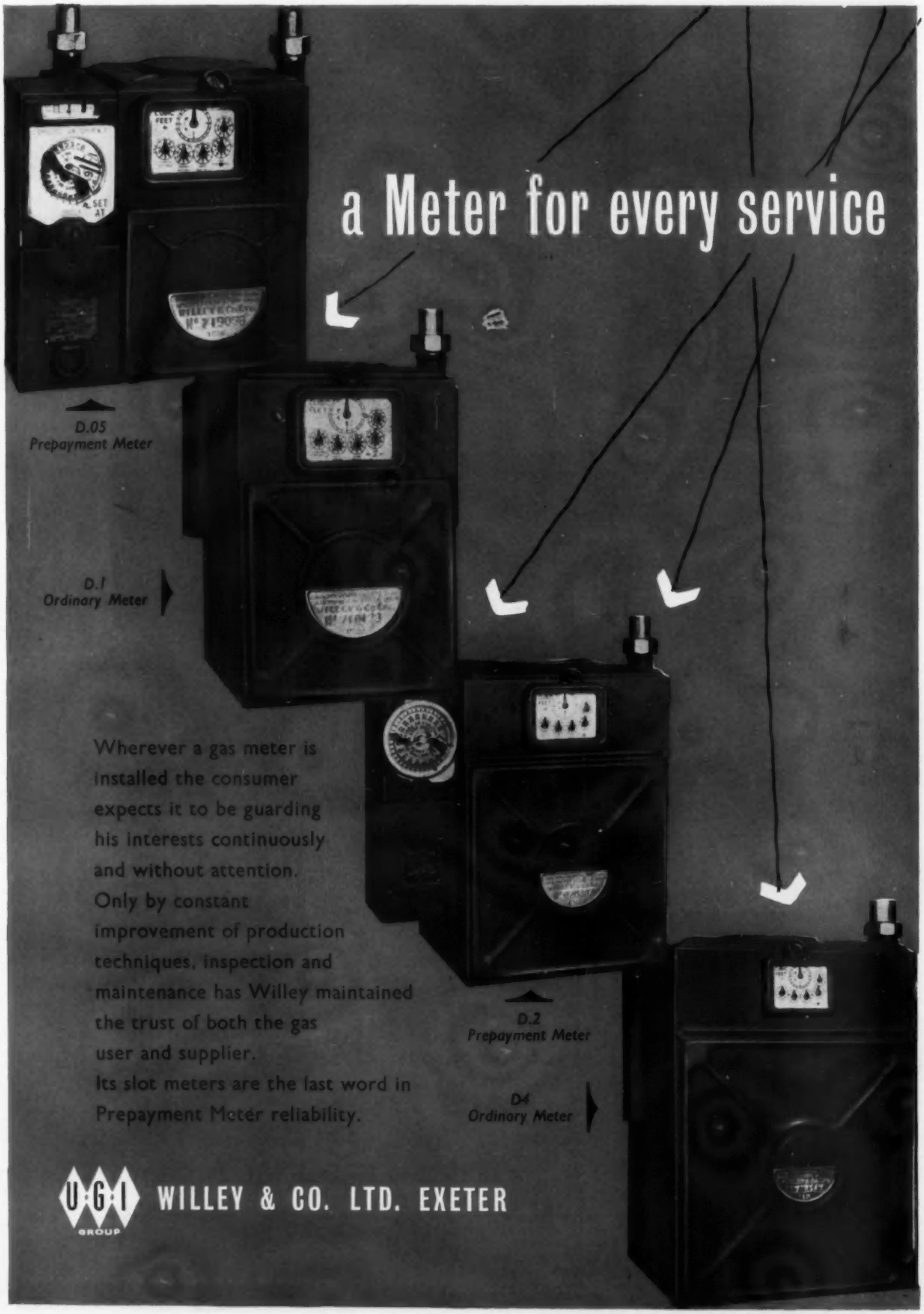
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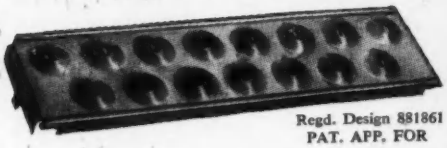

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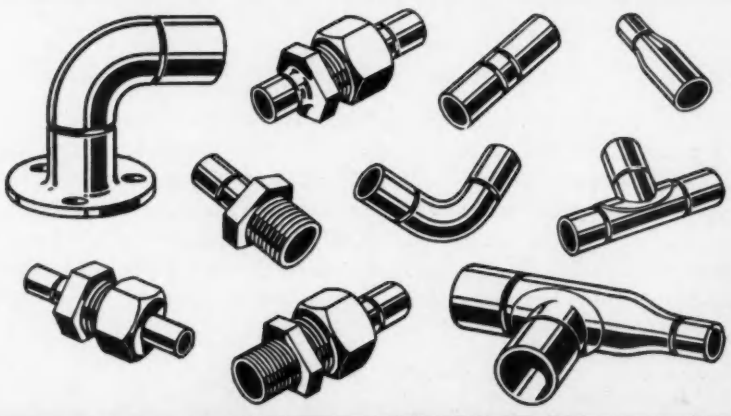

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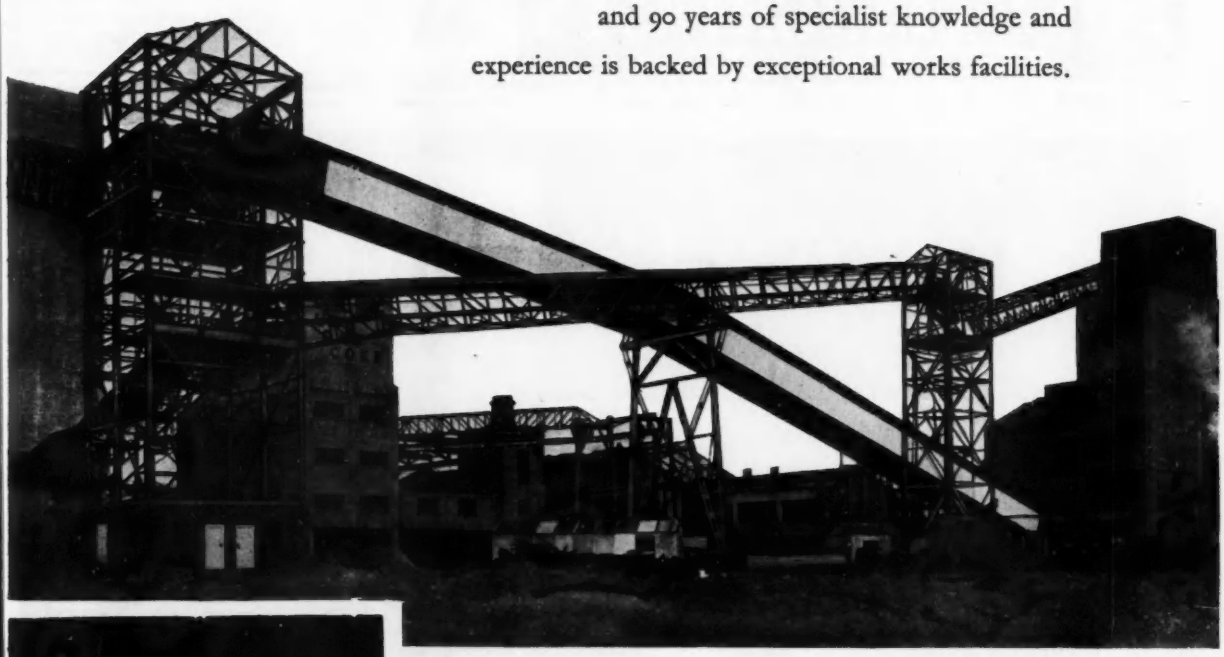

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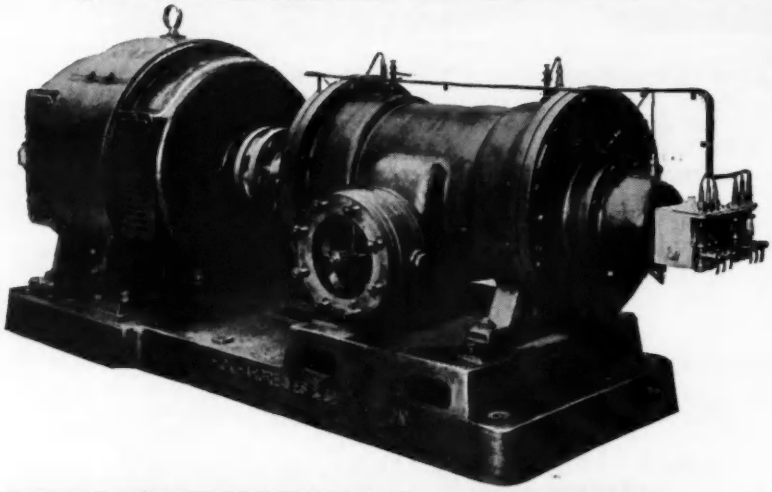

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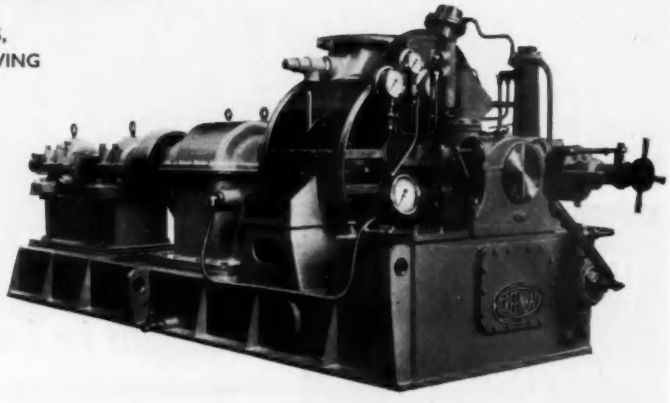

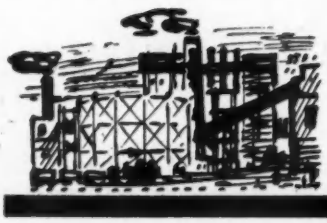

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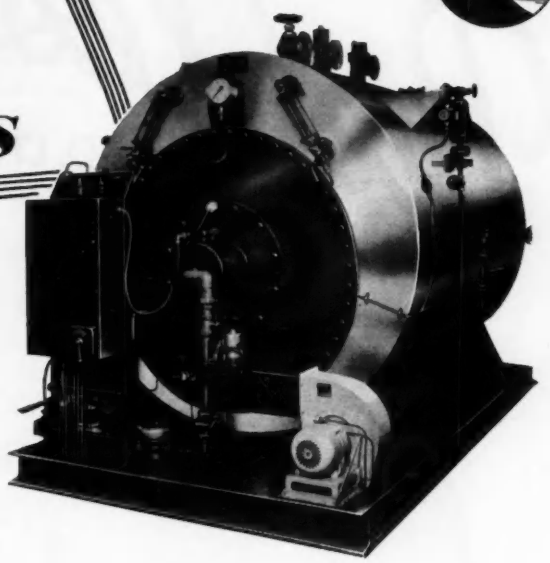
SPANNER PACKAGED BOILERS

Swirlyflo Tubes



GAS-FIRED

•

FULLY AUTOMATIC

A packaged boiler is a complete steam producing unit, wherein the boiler, fuel burner, draught system and feed water tank are completely self-contained on one chassis.

Spanner Swirlyflo packaged boilers are available as vertical boilers as well as horizontal.
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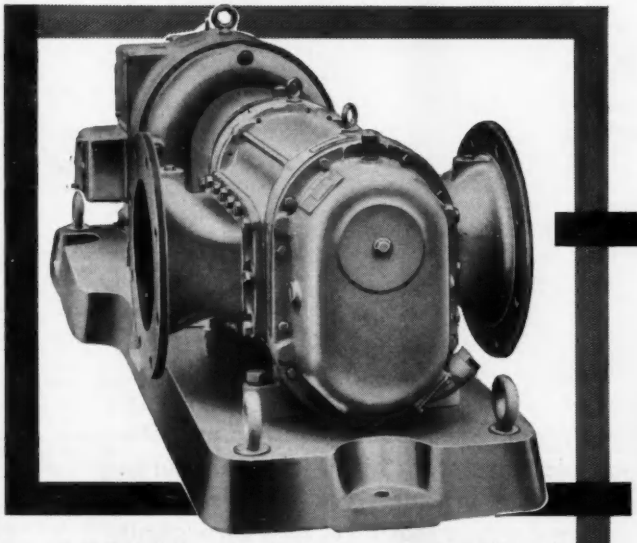
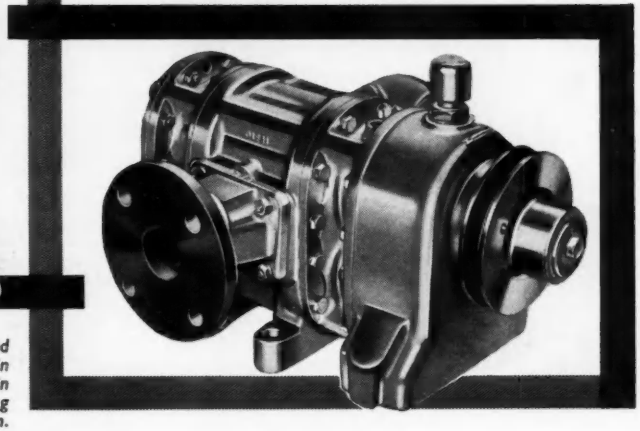
Godfrey Gas Boosters





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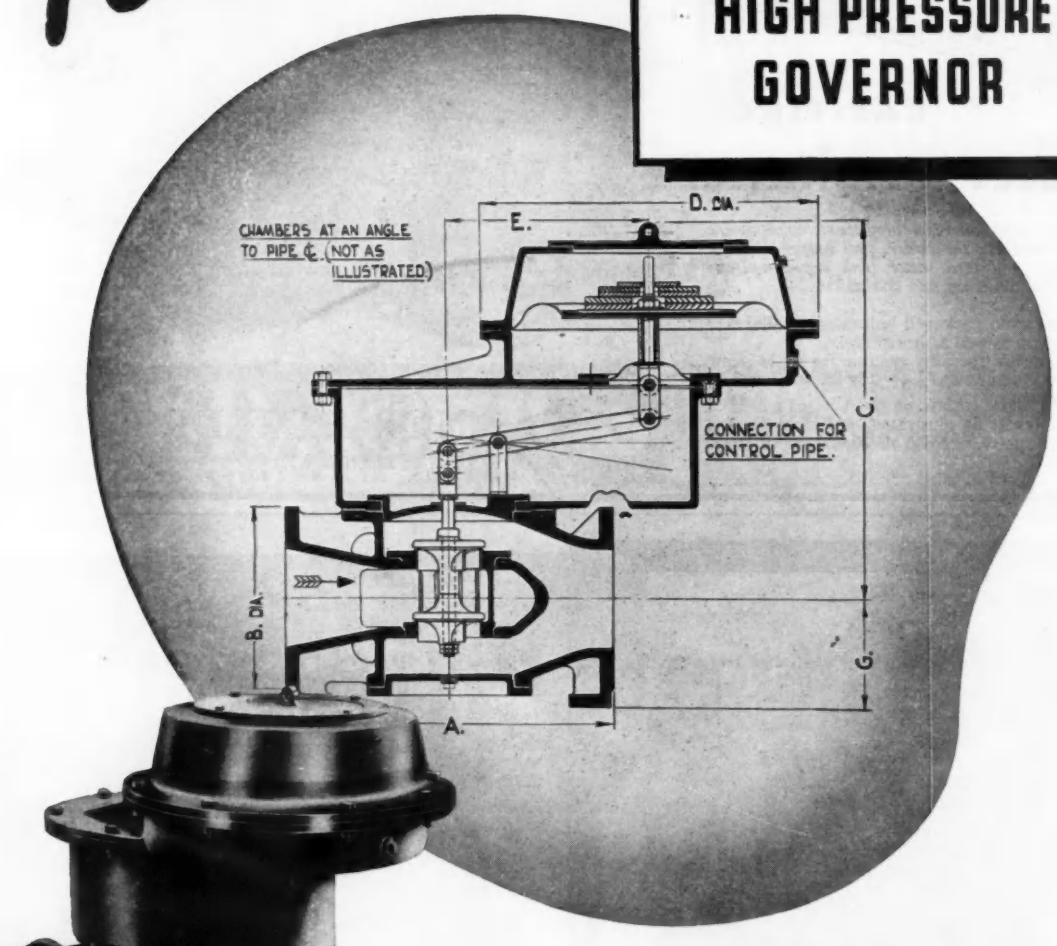

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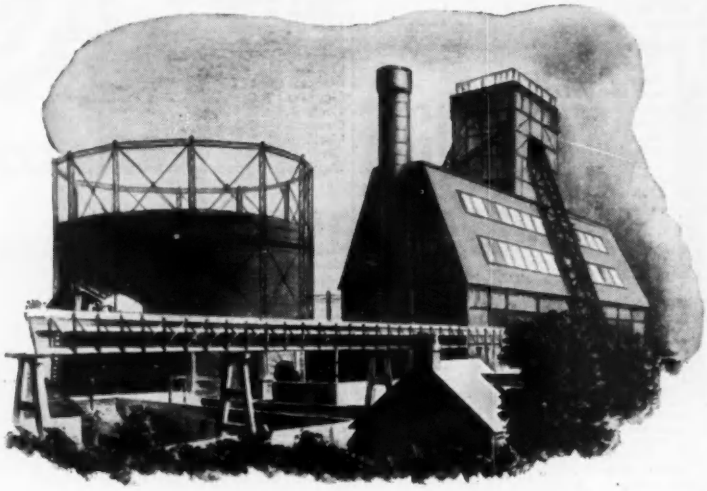

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Gas Journal

VOL. 290 NO. 4902 June 26, 1957

109TH YEAR

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Gas Journal

VOLUME 290. No. 4902. JUNE 26, 1957. 109th YEAR

Some Comfort in the Crystal

AMONG those who have some interest in, or specialised knowledge of, the fuel industries, speculation on the future of gas is fast approaching the proportions of a national sport. The electricity industry, conscious of its good fortune in being allied to the nuclear power programme (though we cannot see why the advent of nuclear energy should guarantee a rosy future for *everyone* in electrical circles), is putting the final touches to the obituary notice they started writing Heaven knows how long ago and which they have found irritatingly slow to complete. The solid fuel brigade (in which of course we have an interest) is enjoying a short-term prosperity and, seeing nothing much to worry about during the next 15 years is taking pains not to look beyond that period. And the Government? Nobody really knows. Mr. Geoffrey Lloyd gave little to go on, Mr. Aubrey Jones gave no comfort at all, and now we have Lord Mills who certainly seems to have more of a policy than his predecessors but whose attitude towards the gas industry has yet to be revealed to the world. The fact is that our future is anybody's guess—and everybody is guessing.

Among the speculators must be numbered the writer of an article in the June 19 issue of *The Times*, a writer who succeeded in arranging within the confines of a relatively short article a good proportion of the factors involved in this difficult and complex question. He points out that the situation which atomic energy will present is basically new, and that since the price of electricity will be progressively less linked to the price of coal, electricity based on atomic energy will ultimately be cheaper than the cost of electricity made from coal. The cost of getting coal will on the other hand probably tend to rise faster than any general inflation or than the rise in the level of earnings. What then, he asks, will be the scope of the gas industry in future? Is there scope for cost reductions which will enable it to sustain if not increase its present scale of operations?

The writer suggests that the answer will be dictated by institutional influence and bias, pointing out that there may be restrictions on investments in gas merely because the electricity programme is very costly, and electricity prices for domestic consumers may well be kept too low. Fundamentally, he says, two questions must be asked: Is it possible to find cheaper ways of supplying gas, and is it possible to increase the efficiency in the use of gas?

Pointing out that there has been a considerable amount of change and experimentation in methods of making or obtaining gas in the last few years, he instanced the development of methods of using heavy oil, with the aid of catalysts. 'It is possible that plants converting heavy oil residues under high pressure which require less capital and labour than orthodox carbonising units may lower the industry's production costs for base loads. The second method of reducing these costs may be found in the complete gasification of house grade and therefore cheaper coals than the gas coals required in retorts and coke ovens. Gas-making coals have become relatively dear because they are scarce; and the electricity industry thrives on cheaper coals of poorer quality. One gas authority at least, the North Thames Gas Board, has had promising results from complete gasification of this grade of coal. Other methods of complete gasification, notably the Lurgi process, have been used on the Continent and elsewhere, though their applicability in British circumstances has not been established.'

That, we suggest, is fair comment, but we find it difficult to agree with the writer when, after describing the possibilities of importing liquefied natural gas, he states: 'it is thought the rewards in the terms of cheaper gas would be substantial.' Finally, he notes that though underground gasification of coal has only become nearly practicable in Britain for making a low-grade gas, it may be improved to produce a high-grade gas.

All these methods would produce more gas without producing a smokeless solid fuel as a by-product. After pointing out that in the immediate future there is likely to be an increase in demand for coke and analogous fuels, through the operation of the Clean Air Bill, and referring to the North Thames and North Western Boards' production of new smokeless fuels for open fire grates, the article goes on to explain how this outlet may in time increase the earnings from the solid fuel produced by conventional retort and coke oven operations. Indeed solid fuel could become the main product with gas as the by-product, but if prices for solid fuel are considerably increased, which would allow gas to be sold more cheaply, the net effect in the long run might be to encourage progressively more use of electricity or oil.

From production the writer turns to utilisation and, after quoting various efficiency figures, points out that

the newer types of gas fires give a substantially better overall efficiency than with electricity for space heating —that is to say, having regard to production efficiencies. Nevertheless, leaving aside greater efficiency in using present types of equipment, which as the North Western Board's recent figures show, can still yield good results, 'the possibility that the cost of gas may not increase with every rise in the price of gas coal is a real one. But it will need enterprise as well as scientific skill to exploit it and the economics of it will depend much on relative prices of oil products and different grades of coal.'

On this somewhat inconclusive note the article ends. Its title 'British Gas Industry Faces the Future' is probably justified in that the author shows the *state* in which the industry faces the future, but he certainly gives little more than a hint of what the future may be. In fairness it should be mentioned that he shows a good grasp of the commercial conditions in operation, although we have not considered it necessary to quote these passages the content of which would be familiar to readers. What we think the author has failed to show is the fact that for a long time to come coal must remain a basic, valuable raw material from which every ounce of goodness must be extracted. As far as can be foreseen, most of these materials will not be obtainable by any nuclear process, and so long as its supply continues coal will remain the source of all the things familiar to us in those much publicised by-product lists. It is possible that the *emphasis* on coal carbonisation may change, but as long as coal is carbonised and chemically processed it will be in the national interest to retain a proper commercial outlet for gas.

La Semaine Gazière

'GAS WEEK' is not to be confused with the Annual Congress of the Association Technique de l'Industrie du Gaz en France which, as we announced in a recent issue, was to be held at Bordeaux early this month. As the President pointed out in his opening remarks, 'Gas Week' is not a conference where those present were at liberty to express their own opinions on the questions discussed but a week during which information was imparted to young engineers who, in the pressure of their daily work, have not always the time to keep themselves informed of what is going on in the industry whether at home or abroad.

La Semaine Gazière, 1957, was opened on April 9 at Chemistry House, Paris, with M. Nérot, President of the Association Technique (under whose direction the meeting is organised) in the chair. All the addresses are reported more or less fully in the May issue of the *Journal des Usines à Gaz*.

The opening address was delivered by M. Le Guellec, President of the Administrative Council of Gaz de France. He went over, again, the difficulties which the gas industry in France faced in the years following the devastations of war. Today the industry was in the full tide of expansion, but they must look far ahead.

M. Le Guellec reminded his audience of the objectives of the 'Third Plan of Equipment.' It contemplated for 1961, the production of 5,250 mill. m³ (185,000 mill. cu.ft.) of manufactured gas supplied by gasworks and coke oven plant; for 1975, 6,000 mill. m³ (212,000 mill. cu.ft.).

But among their 'hopes for tomorrow' was the development of the deposits of natural gas in the South West. Those of Lacq, where reserves were certainly of the order of 150,000 mill. m³ (5,000,000 mill. cu.ft.), but were very probably double that, exhibited difficult characteristics, unique in the world; they represented reserves at least equal to those of the Po Valley of Italy. At Parentis, deposits recently discovered and upon which they still awaited accurate information, there was 'non-acid' gas which would not present the problems associated with Lacq. The natural gas objective of the Third Plan was the production in 1961 of 4,000 tonnes of coal equivalent, with the possibility of twice that in 1965. One could be sure that the figures of the plan would be attained because Lacq alone would produce 20 mill. m³ (710 mill. cu.ft.) of crude gas per day in 1965, say, 6 mill. tonnes 'equivalent coal' per annum.

Their second hope lay in oil refinery gases, the production of which would grow with the tonnage of petroleum refined. And the steelworks and collieries, which are increasing their capacities particularly in Lorraine, will have growing quantities of gas available to Gaz de France.

Another source of gaseous energy which would probably be available in the near future was the methane from the oilfields of Venezuela and the Near East which is capable of being transported by 'tanker' in liquid form. 'And I mention, not only for the record, the natural gas of the Sahara.' There were here technical problems to be solved.

It was evident (as the Editor remarked) that natural gas was the 'star item' in the programme of this Semaine Gazière. M. Kuhn de Chizelle, turning the pages of his recent travel diary, showed the importance which is attached to its utilisation in the immense territories of the U.S.S.R, and the hopes based upon the development and distribution of natural gas in the future, while MM. Iuéret and Renauldson gave a general view of the position of natural gas in the U.S.A. and the technique of its transmission over the vast distances of North America. M. G. Roberts, Commercial Director of Gaz de France, described in some detail the natural gas deposits of Lacq—a subject which could hardly have been more timely, since it was less than three weeks later that the Ste. Nationale des Pétroles d'Aquitaine announced the emission of the first cubic metres of purified gas from this source into the distribution network of the Ste. Nationale des Gaz of the South West.

The development of the Lacq wells presented nearly all the difficulties imaginable in such a deposit; great depth (3,500 to 4,000 metres), abnormal pressure (670 kg/cm), acidity (H_2S content 15%, CO_2 9.5%). These two gaseous impurities, acting on steel tubes subject in the wells to high tensile stresses, provoked not only general corrosion but also crystallisation leading to rupture. It was consequently necessary, before proceeding to full production from the wells, to find a metal for the tubes resistant to the attack of the gas. In September, 1955, tubes resistant to H_2S were put into service but the search is still going on for a steel completely resistant to general corrosion in order to obviate the necessity for inhibitors and the limitation of velocity of the gas in the tubing.

Personal Notes

SIR HAROLD SMITH, K.B.E., Chairman of the Gas Council, and SIR GRAHAM SUTTON, C.B.E., Director, Meteorological Office, have accepted Honorary Fellowship of The Society of Engineers. It is hoped to present their Scrolls to them at the annual dinner on October 11. Honorary Fellowship is the highest award the Society can bestow and the number is limited by the Articles and By-laws to 25.

SIR HAROLD ROXBEE COX and DR. C. J. SMITHELLS have been appointed Members of the Council for Scientific and Industrial Research. Sir Harold is a Director of Wilmot-Breeden (Holdings), Ltd., and of The Brush Group, Ltd. Dr. Smithells is Managing Director of Magnesium Elektron, Ltd.

MR. GEORGE WALMSLEY, M.B.E., was presented with a television receiver on the occasion of his retirement as Engineer, Managing Director, and Secretary of the Londonderry Gaslight Company, recently. Sir Basil McFarland, Chairman, and Mr. T. McDougall, Manager, were among those who paid tribute to Mr. Walmsley.

SIR NEVIL MACREADY, BT., has been appointed Manager of Supply Department of Mobil Oil Company. He will report to MR. J. A. PAUL, who, since the beginning of the year, has carried out the dual function of Director and Manager of this Department.

MR. OFFORD BUXTON has been appointed Education and Training Officer for the East Midlands Gas Board at Leicester. He succeeds Mr. A. G. D. Collis, who has been appointed Middlesex County Council Establishments Officer.

MR. IAIN MAXWELL STEWART, and the RT. HON. LORD BRIDGES, P.C., G.C.B., G.C.V.O., M.C., have been appointed to the Board of Directors of Babcock & Wilcox, Ltd.

MR. W. A. ('TIM') COLEMAN has retired from the North Thames Gas Board after more than 45 years' service. Mr. Coleman joined the former Gas Light and Coke Company in 1912. In the first world war he served in France with the Rifle Brigade and was severely wounded in 1917. After the war he resumed with the Company, working in their offices at Fulham and later at Hounslow, where he remained for the rest of his service, and where Mr. D. Rouse, Western Divisional Manager, recently made a presentation to him to mark his retirement. Mr. Coleman was a founder member of the British Gas Staff Association, on whose National Council he has served since its inception. In 1950, he was elected to the North Thames Area Joint Council and the Area Standing Joint Committee, and in 1955 was elected Chairman of the Staff Sides and Chairman of the full Area Joint Council a year later.

MR. J. W. WATKINS, a Member of the British Transport Commission, has been appointed a Member of the Industrial Coal Consumers' Council.

MR. HARRY BREEZE, of Llandudno, has retired from his post as manager of the Llandudno gas showrooms.

Obituary

MR. JOHN EDWIN SISMEY, Director and Secretary of W. H. Sismey & Co., Ltd., of Halifax, and the associated Company, Sismey & Linforth, Ltd., of Birmingham, was killed recently in a motor-car accident. He was 43 years of age and leaves a widow and two young sons.

W-D Get £1.5 Mill. Order for Coke Oven Extensions

Extensions to the coking plant at the Redbourn works, Scunthorpe, of Richard Thomas and Baldwins, Ltd., are to be carried by the Woodall-Duckham Construction Co. Ltd.

The order, which is valued at over £1.5 mill., includes two further batteries totalling 62 coke ovens with a daily coal carbonising capacity of some 1,300 tons, by-product recovery plant and coal and coke handling plants.

The three batteries of W-D Ovens now operating at Redbourn carbonise over 2,000 tons of coal daily.

BANGOR TURNS LOSS INTO PROFIT

BANGOR (Co. Down) Borough Council's gas department made a profit of £616 16s. 7d. for the year ended March 31, compared with a loss of £1,628 7s. 2d. for the previous year, it was stated at a recent meeting of the Council.

Alderman F. Logan, Chairman of the gas committee, said there had been a 1.3% decrease in volume of gas sold, due partly to the replacement of gas lighting by electicity in part of the town. Due to credit restrictions appliance sales, at £19,954, were £3,000 lower than in the previous year. Revenue from coke, at £40,000, was £4,800 more than last year.

Alderman Logan was re-elected Chairman of the gas committee for the twenty-first year, and Councillor William McKelvey was appointed Deputy Chairman.

Diary

June 26.—THE INSTITUTION OF GAS ENGINEERS, SOUTH WESTERN SECTION: Summer Meeting and Ladies' Day.

June 27.—N.T.G.B. CONSULTATIVE COUNCIL. 2.30 p.m. Westminster City Hall, Charing Cross Rd., W.C.2.

June 28.—WALES GAS CONSULTATIVE COUNCIL: Council Chamber, Town Hall, Llandudno, 11 a.m.

June 29.—WESTERN JUNIORS: Imperial Hotel, Ilfracombe. 12.30 p.m. Summer Meeting and Ladies' Day.

July 2.—SOUTH EASTERN G.C.C.: Caxton Hall, Westminster, 2.15 p.m. Committee Room, Gas Offices, Edmund Street, Birmingham 3, 2.30 p.m.

July 22.—WEST MIDLANDS G.C.C.: Committee Room, Gas Offices, Edmund Street, Birmingham 3, 2.30 p.m.

Simon-Carves to Build Coke Ovens in Australia

SIMON-CARVES, LTD., have received from Australian Iron & Steel, a subsidiary of the Broken Hill Proprietary Co., Ltd., the contract for a complete new coke oven battery and by-product plant at the Port Kembla steelworks.

The battery will comprise 96 twin-flue compounds underjet ovens in two blocks of 48 ovens each, and will carbonise about 1 mill. tons of coal a year.

It is believed that this will be the largest coke oven battery in Australia and that it will also be the first coke oven installation of British design to be built in Australia by a United Kingdom firm.

Radioisotopes for New Pipe Line

SOLUS-SCHALL, LTD., have received a contract from Taylor Woodrow, Ltd., to carry out gamma radiography on a 10 in. pipeline from Port Harcourt in Nigeria to Oloibiri, near Kuglo, 60 miles away, where a new oil strike has been made. The line is being constructed for Shell Petroleum (Nigeria), Ltd.

The project is scheduled for completion at the end of next January, 1958. The work will be carried out by two radiographers using four radioactive isotopes; they will have to travel through rocky and swampy country using Land Rovers and canoes.

De La Rue Open New London Showroom

THE new showroom of Thomas De La Rue & Co., Ltd., which was opened on June 13, must rank as one of London's most modern and varied displays. Occupying the whole of the basement of De La Rue House at 84/86, Regent Street, the showroom includes a Formica advisory service, theatre and stationers division, but the sections most likely to interest the gas industry are the display of Potterton Division products and the display kitchen.

Uses of Formica

In the latter the Plastic and Potterton Divisions have combined to produce a kitchen illustrating present uses of Formica plastic and possible future trends of cooker design. Extensive use has been made of Formica post-forming grade to provide a splash-back behind the sink which curves to form an integral part of the Formica plastic wall cladding behind, as well as on the sliding doors. The kitchen appliances, in a warm shade of mushrom pink relieved with white and chromium-plating, show a possible future trend towards specialist built-in appliances, including for cooking purposes a hotplate separated from the oven and grill, so that each part may be at the most convenient position and level in the kitchen. The hotplate includes two boiling rings of conventional design alongside three sunk cooking vessels, securely held for stirring contents, and capable of individual control at any desired temperature, with the heat transfer so arranged that the risk of burning is reduced to a minimum. All cooking vapours are extracted from above the hotplate, and illumination into the vessels is provided by concealed lighting. On the adjacent wall are two ovens, the top one for normal temperature baking and roasting, the lower for low temperature cooking such as meringues, and for plate warming. Above the top oven is a grilling unit.

In addition to the boilers displayed in the showroom there will be later this year a display of boilers which can actually be seen in operation. The boiler room, easily accessible from the showroom, is at present being remodelled, and when it is completed, it will house some of the larger models of Potterton boilers which will serve the central heating and domestic hot water requirements of De La Rue House. Besides showing working boilers, the boiler room will also be a typical example of a modern boiler installation illustrating current boiler-house practice with regard to flues, pipe work, etc.

Metropolitan-Vickers

Metropolitan-Vickers Electrical Co. Ltd., have changed the address of their transformer department to Southmoor Road, Wythenshawe, Manchester, 23. For cables and telexes, the department will continue to use the Trafford Park address: Metrovick Manchester telex 66-314.

FESTIVAL OF WOMEN EXHIBITION

The Women's Gas Federation stand at the Festival of Women Exhibition now being held at Wembley.

A Sinking Feeling— then Fitter was Hurled Across Street

A SINKING feeling is all that Ronald Peach, West Midlands Gas Board fitter, remembers of the gas explosion which wrecked the house in which he was working, blew him out of the window, and hurled him across the street.

This 'mystery' blast, as it was described by a Gas Board official, occurred in a cavity under the floor when Mr. Peach was examining a meter. He was taken to hospital with both ankles broken and suffering from cuts and shock.

Nearby houses were damaged and firemen stood by for two hours in case of fire. The street was closed to traffic.

ULTRASONICS FOR PIPELINES

METAL and Pipeline Endurance, Ltd. (Mapel), are operating an ultrasonic set on the 24-in. diameter 16-mile welded steel gas line being laid between Romford and Shellhaven.

The use of ultrasonics on a pipeline in the field is a comparatively new development in Britain and has been undertaken by MAPEL, to ascertain its value in comparison with visual and radiographic inspection.

Results so far obtained give reason to hope that a combination of ultrasonics and radiography will provide a means of ensuring the highest quality welding on high pressure long distance pipelines.

S.E.G.B. CHEMICAL PRODUCTS

The Chemical Products Department of the South Eastern Board have been transferred from Regis House, King William Street, London, E.C.4, to Corn Exchange Building, 52/57, Mark Lane, London, E.C.3. Telephone, Royal 8066; telex, 2-3722; telegrams, Chemetro Fen London.

The chemical accounts office will be at Corn Exchange Building, but remittances should continue to be sent to 709, Old Kent Road, S.E.15.

GAS APPLIANCES IN CREMATORIUM

A GAS-FIRED boiler and incinerators have been installed at the crematorium, Markeaton Lane, for Derby Corporation.

The incinerators are of the NEGAS type and the boiler is an Ideal gas-fired appliance which provides the whole of the heating of the building by either conventional central heating radiators or fan blown hot air units in the chapel and outer room.

Sir Harold Smith Predicts National Gas Grid

OPENING CEREMONY AT LITCHURCH

A NATIONAL gas grid fed by works using numerous gas-making processes, by coke ovens and oil refineries, and with imported liquid methane was forecast by Sir Harold Smith, Chairman of the Gas Council, when he opened the new Litchurch works of the East Midlands Gas Board last week.

Sir Harold also referred to the possibility of the heat of atomic reactors being used for new gas-making techniques. But he warned that, with rising costs, a greater contribution to the outlay on new plants might have to be borne by the consumer in increased gas prices.

Unveiling a plaque commemorating the opening of the new works, Sir Harold wished all who worked at Litchurch the best of luck. Later, when he proposed the toast of the East Midlands Gas Board, he said the new works had been conceived by the present and third Board Chairman, Mr. R. S. Johnson, M.B.E., the first Board Chairman, now Deputy Chairman of the Gas Council, Sir Henry Jones, M.B.E.; and the second Board chairman, Mr. Sydney Smith, C.B.E., now Chairman of the Scottish Board.

He was sure that all who had seen the new works had been impressed. As a gas engineer he would say that it was a 'jolly good job.' One would have to go a long way to see a better works.

The East Midlands Board, said Sir Harold, had comprised industrialists, who probably hated the idea of nationalisation; representatives of municipalities, who might have liked the idea of nationalisation until they found their own municipality was getting very little out of it; and representatives of trades unions. Then they had had full time Deputy Chairmen, who had been engaged professionally in the gas industry—a heterogeneous mixture from which a team had been formed.

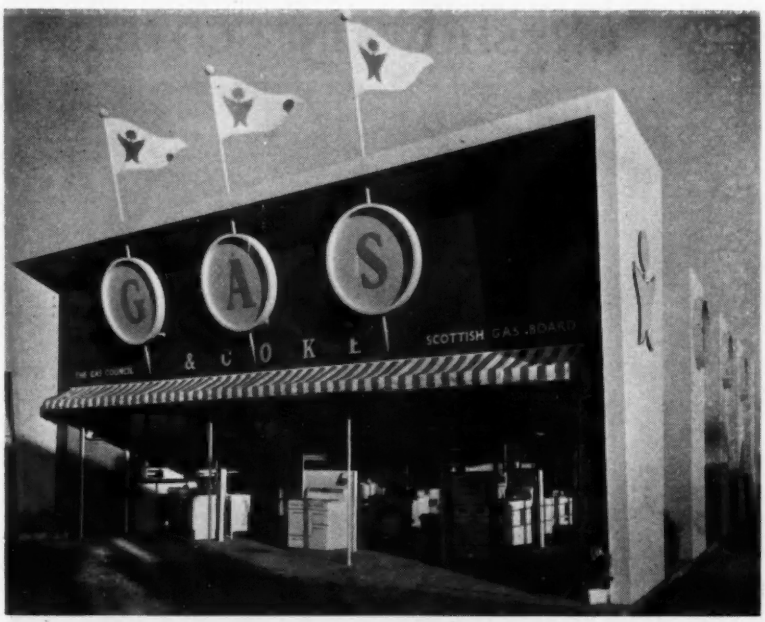
Mr. Johnson paid tribute to the work of Mr. K. L. Pearce, Divisional General Manager, and to Mr. Gwynne Davies, Secretary of the Board, and their staffs who made the visit to the works possible. The Deputy Chairman of the Board, Mr. E. H. Harman, proposed the toast of the guests and referred to the presence of many Chairmen of area boards, contractors, directors, and representatives.

Sir Henry Jones said the success of the East Midlands Board was due to its team spirit. It was more than five years since he had left the area and it was a great pleasure for him to re-visit the works. He had been impressed by their condition.

Sir Harold Smith, Chairman of the Gas Council, unveils the plaque commemorating the opening of the new works. With him, left to right, are the Mayor of Derby; Mr. R. S. Johnson, M.B.E., Chairman, and Mr. E. H. Harman, Deputy Chairman, East Midlands Gas Board.

CV Measurements

Instruments installed at the new Litchurch works of the East Midlands Gas Board for recording the calorific value of gas were of the Fairweather type supplied by Scientific and Projections, Ltd.



Gas and coke in the service of the farmer's wife was the theme of the Gas Council stand, pictured above, at this year's Royal Highland Show in Dundee. All the latest domestic appliances were on show and home service advisers gave cooking demonstrations in a specially equipped kitchen.

BATH WIN S.W.G.B. ANNUAL FIRST AID COMPETITION

TORQUAY were the winners of the South Western Gas Board's third annual first-aid competition, held in Bath on May 31, with Swindon second, and Bristol 'B' third.

Torquay will represent the Board in the national gas industry first-aid finals in the autumn, and the Swindon (ladies) team will compete in the ladies' section.

The Deputy Chairman of the Board, Mr. James Carr, O.B.E., presided at the distribution of prizes and congratulated the teams and the Board's first-aiders in general on the fine voluntary work they undertook. Lieut.-Col. J. E. F. Gueritz, General Secretary of the St. John Ambulance Association, also congratulated the teams and spoke of the increased interest and activity in the field of first-aid in the gas industry.

S.E.G.C.C. Meeting

Elimination of tariff differentials and a further move to slash purchase tax on gas appliances were discussed at a recent meeting of the South Eastern Gas Consultative Council held under the chairmanship of Dame Alix Meynell.

CHEMICAL PLANT BUILDERS FORM NEW ASSOCIATION

TO provide a complete and comprehensive construction service to the chemical processing and manufacturing industries, John Laing and Son, Ltd., and The H.K. Ferguson Co. of Great Britain, Ltd., are forming a separate association in the name of Laing-Ferguson.

The integration of all aspects of construction under a single controlling responsibility has already proved a means of achieving a significant and much needed speed-up of completion schedules in this class of work.

The Laing organisation is well known in Britain and the Commonwealth for its achievements in building and heavy civil engineering work for industry. These include the twin atomic piles in West Cumberland for Britain's first plutonium-producing establishment and construction work of gold mining and uranium plants in the Orange Free State and in the Transvaal.

Complementary Interests

The H.K. Ferguson Company, a subsidiary of The H.K. Ferguson Company of America, is already established in this country and has collaborated with the Laing organisation on the new foundry for the Ford Motor Company at Dagenham. The interests and objectives of both companies have proved complementary and working together on the Ford project has developed into the new Laing-Ferguson association.

COUNCIL TO HEAR GAS BOARD PLEA

BY a casting vote Falkirk Town Council have agreed to receive a deputation from the Scottish Gas Board regarding a recent decision to install only electricity in future housing schemes.

A letter from the Gas Board, read at a meeting of the Town Council on May 27, said that the decision might affect their ordinary service not only in Falkirk, but throughout Scotland.

Another letter from R. & A. Main, Ltd., Camelon, Falkirk, stated that they felt grave concern over the decision not to use gas, which would affect employment in the area.

Search is Switched

The search for natural gas in the North Riding of Yorkshire, which has been pursued in recent months near Robin Hood's Bay by Imperial Chemical Industries, Ltd., in association with the B.P. Exploration Co., Ltd., is being switched to a site on Sleights Moor near Blue Bank on the Pickering-Whitby road.

Curbing Meter Thefts

AS a means of curbing thefts, prepayment meters are not to be installed in new Greenock Corporation houses or as replacements in older houses unless specifically requested.

SCOTTISH FIRST-AID TEAMS SELECTED

Edinburgh men and Perth women will provide the Scottish element in the national first-aid championship to be held in London in October.

At the Scottish Gas Board's competition, held in Edinburgh, a team of women from Perth Group won the women's event with 236 points out of a possible 350. Runners-up, five points behind, were Glasgow and Western, and Edinburgh took third place with 226½ points. Edinburgh A team were the winners with 311 points. Perth B and A teams took second and third place with 268 and 261½ points respectively.

Week-end Course

District managers and sales superintendents of the Scottish Gas Board recently attended a week-end sales management course at the Newbattle Abbey Adult Residential College, Dalkeith. The course was arranged by Mr. R. J. Faulkner, Education and Training Officer, and the programme was drawn up in consultation with Mr. A. L. Jackson, Governing Director of Sales Consultants Ltd., Leicester, and his co-Director Mr. G. C. Leich.

SCOTTISH WESTERN JUNIORS HOLD GOLF OUTING

THE SCOTTISH Western Junior Gas Association's annual golf outing was held at the Cardross golf course, near Dumbarton, on June 14, and was supported by 32 members.

The excessive heat and hardness of the course affected many members' play, but the afternoon was remarkably successful and was concluded with tea at the end of play.

The President, Mr. W. A. Green, welcomed members and conveyed the Council's thanks to Mr. L. Fletcher of the Parkinson Stove Co., Ltd., for his part in organising the outing, and to Mr. S. Patterson, Production Engineer, Glasgow and Western Division, for assisting with the arrangements.

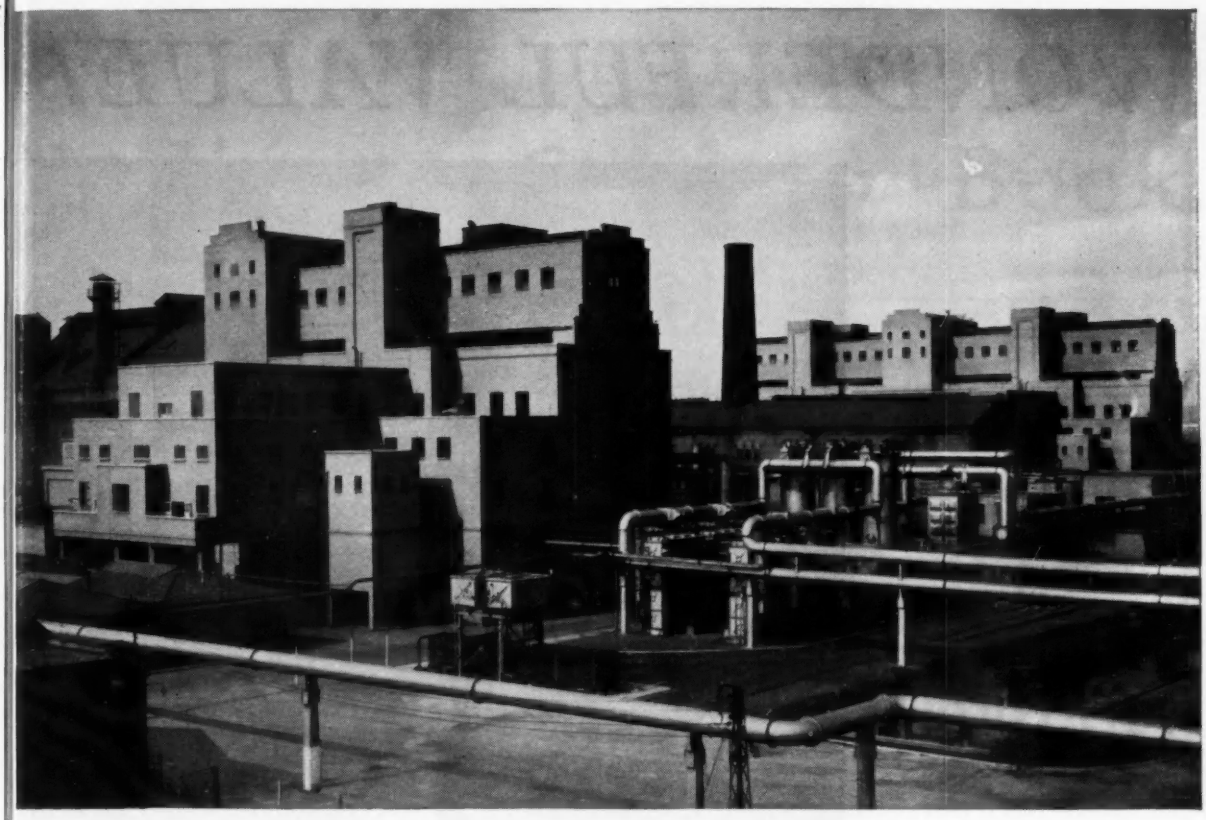
Results were—silver trophy and first prize, Mr. Thomas Thompson, Alder & Mackay, Ltd., 61 net; second prize, Mr. Holmes Johnstone, Parkinson & Cowan, Ltd., 73 net; third prize, Mr. Trevor Cooper, industrial section, Glasgow and Western Division, 74 net. The best individual score was obtained by Mr. Holmes Johnstone with 78.

Glasgow Victory

The Scottish Gas Board, Glasgow Division, beat The Scottish Association of Gas Managers Bowling Club by 48 shots in the annual match at The Scottish Gas Board, Social Welfare Club grounds, Glasgow, on June 8.

GAS ON SHOW IN SCOTLAND

Pictured above is a view of the Scottish Gas Board stand at Scotland's Own Ideal Home Exhibition recently concluded in Edinburgh. Results were most satisfactory, 800 enquiries being received for cookers, gas water heaters, gas heated wash boilers, gas-fired space heaters, gas hotplates, and other appliances.



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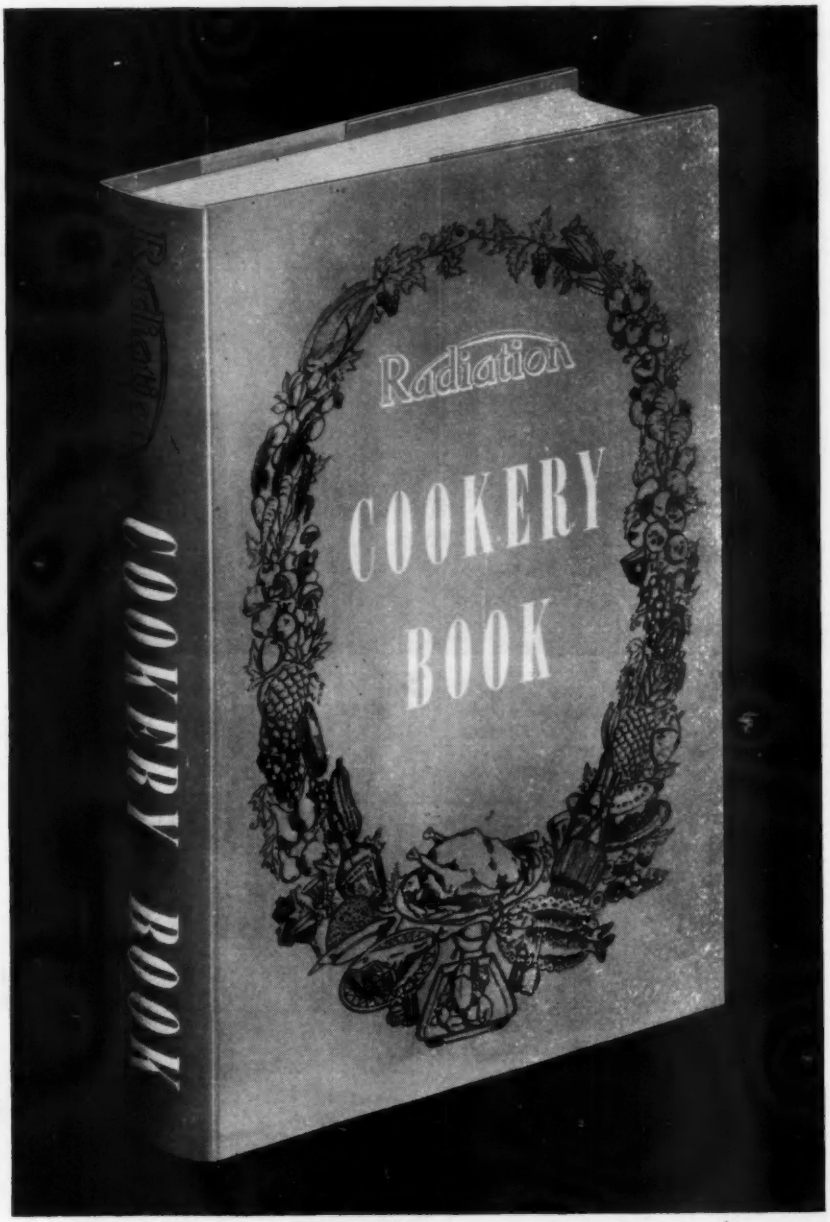

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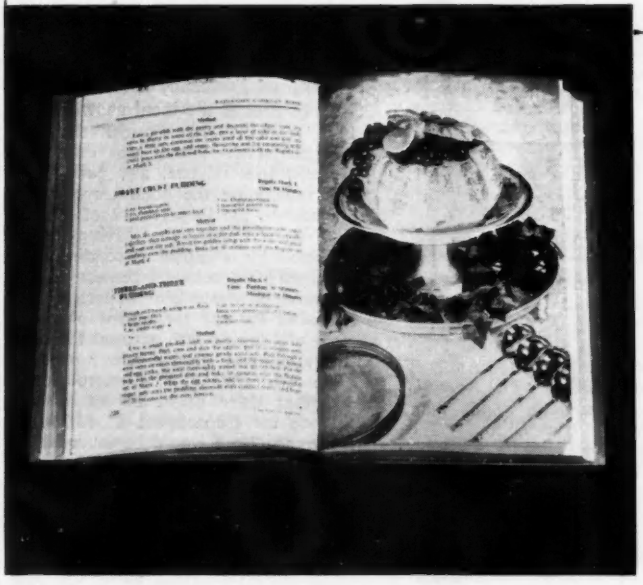

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BRITAIN'S FIRST MANUFACTURERS OF 40-FT. STEEL PIPES AID BALANCE OF TRADE

EXPORT orders being taken by the South Durham Steel and Iron Co., Ltd., Britain's—and, indeed, Western Europe's—first company to manufacture 40-ft.-long steel pipes to meet United States specifications, are already making an important contribution to the balance of trade. This was stated by Mr. G. E. P. Thorneycroft, M.P., then President of the Board of Trade, when he officially opened the extension to the Company's steel pipe department at Stockton, recently.

Construction of the Company's original plant to produce steel pipes up to 30 ft. in length and 26 in. in diameter was begun in 1925. By 1950 automatic submerged arc welding had been introduced to replace older methods, but it was soon realised that growing world demand for more and larger pipes to revised standard length and specifications could only be met by expanding still further. In 1955, 15 months after the plan had been approved, the new pipe fabrication plant, designed to manufacture steel pipes up to 40 ft. long, from 16 in. to 40 in. in diameter, and from ¼ in. to ⅝ in. in plate thickness, was ready to go into production.

Two Planers Used

The steel plates for the pipes, manufactured by the Company's West Hartlepool Iron and Steel works in compliance with the American Petroleum Institute's specifications, are passed to the first of two 42-ft.-long edge planing machines supplied by Scriven Machine Tools, Ltd. Two planers are used to avoid turning the 40-ft.-long plate. The same procedure is used in the next operation in two plate edge setting machines. The purpose of this operation is to pre-set the longitudinal edges prior to cold bending in the 3,600-ton-capacity 'U' form press which operates at a working pressure of 4,500 lb. per sq. in.

From this press the U-formed pipe or 'skelp' passes to the larger 'O' forming press of 16,000 tons capacity, in which the pipe is finally cold pressed into a complete circle with the longitudinal prepared edges closely abutting ready for automatic submerged arc welding by four Lincolnweld units. A double Vee preparation is used for the heavier plate thicknesses, while square butts are used on thin pipe walls. The internal welding head is mounted on a special fixed boom and the pipe is moved forward at the required speed. For external welding three Lincolnweld twin-arc units are employed with two continuous electrodes fed to the weld simultaneously. Speeds of up to 50% higher than with normal automatic welding have been claimed for this process and on thickness of ⅝ in. speeds up to 36 in. per minute are possible.

Inspection of both internal and external weld seams then takes place, after which the ends of the pipe are machined square to ensure accuracy in the hydraulic expanding and testing operation. X-ray inspection is used and up to 10% of the weld seams are radiographically examined with two sets of Newton Victor of 250 kV capacity. The expanding process to ensure maximum accuracy of circularity and straightness is then carried out in the large hydraulic press built by the Loew Engineering Co., operating at a maximum pressure of 5,500 lb. per sq. in. The pipes are encased in dies of the required diameter and the hydraulic expansion is carefully controlled to ensure the minimum in yield stresses. While the pipe is still in the press after the expansion has taken place, the pressure is reduced and the dies are opened and the weld examined under test pressure.

Subsequent to hydraulic expanding and testing the pipes are taken to the end bevelling machine where the ends are bevelled to suit site requirements. This operation concludes the actual fabrication of the pipe but descaling by hot sulphuric acid and phosphoric acid is carried out if required.

DISAPPOINTED BUT ACQUIESCENT

Following a meeting of the Industrial Coal Consumers' Council at the Ministry of Power last week, the following statement was issued:

'As a Council representing consumers we are bound to express our disappointment that it has become necessary for the National Coal Board to raise prices to meet additional costs. We realise that coal prices in this country are still lower than elsewhere in Europe but our consumer members are naturally fearful of the inflationary effect of the increase.

'Nevertheless, after hearing the National Coal Board's explanation of their need for increased revenue, despite the greater productivity achieved this year, we have come to the conclusion that there is no practicable alternative to the proposed increase.'

THE SOCIETY FOR ANALYTICAL CHEMISTRY

Papers read at a joint meeting of the Western and Midlands Sections of the Society for Analytical Chemistry in Cheltenham, on May 31 and June 1 included 'Recent Advances in the Analysis of Plastics,' by J. Haslam; 'The Analysis of Titanium, Zirconium, and their Alloys,' by W. T. Elwell; and 'The Analysis of the Rarer Elements of Group III,' by A. R. Powell.

A Symposium on Microchemistry will be held in the University of Birmingham from August 20-27, 1958, under the auspices of the Society and is being organised by the Midlands Section and Microchemistry Group.

It will consist of original papers and recent advances in microchemical techniques, presented by a number of chemists of international repute. The subjects will include: Inorganic and organic qualitative and quantitative analysis, absorptiometry, chromatography, polarography, emission spectrography, radio chemistry, chemical microscopy, thermogravimetric analysis, biochemical methods, industrial applications, and teaching.

COLERAINE WORKS MAY SPEND £30,000 TO SAVE FUEL

COLERAINE Borough Council has approved in principle proposals submitted by the National Industrial Fuel Efficiency Service for the saving of fuel at the local gasworks.

In a report to the Council the Gas Committee stated that it was estimated that 1,050 tons of coal and coke were used annually on the boilers, representing a cost to the Department of £7,350.

The report showed that savings could be effected by a capital expenditure of £30,000, £23,000 being in respect of the installation of waste heat boilers.

Allowing for the repayment of these charges and taking into account the cost of the additional electric power needed, the Manager, Mr. W. R. Cameron, estimated that there could be an annual benefit to the Department of £3,364.

The expenditure would be incurred in stages over a period of 45 years.

Up Goes the Price

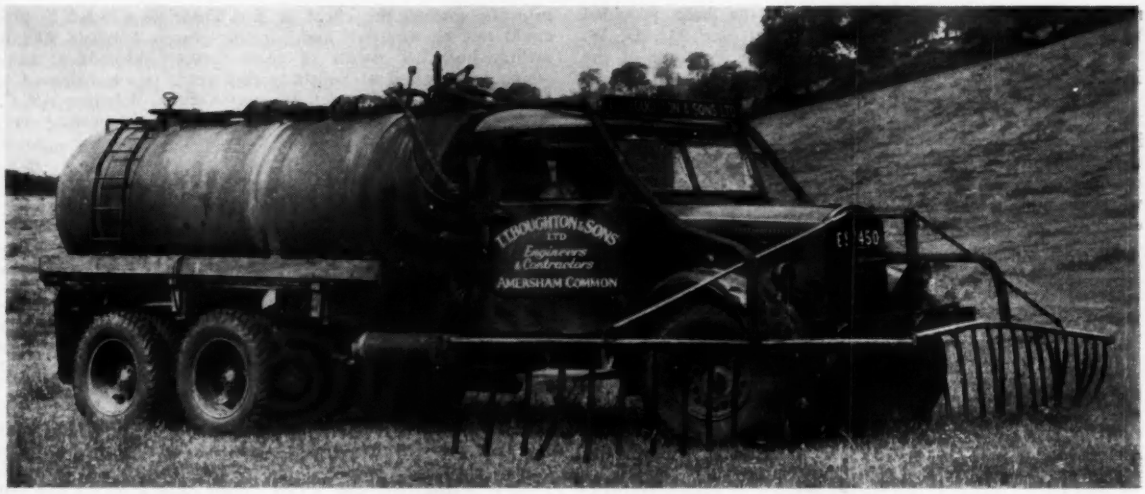
Lisburn Urban Council has confirmed a Gas Committee recommendation to increase the price of gas by 1s. 6d. per 1,000 cu.ft., bringing the price to 11s. 2d. The Gas Department's accountants reported a net loss of £3,878 for the year ended March 31, 1957.

Business Looks Up

Credit balance of Newry Urban Council's gas undertaking was reported at the annual meeting of the Gas Committee by the Manager, Mr. John Collins, to be £3,117 19s., compared with £1,384 11s. 3d. last year.

Honeywell-Brown Ltd.

Honeywell-Brown Ltd. have moved their Manchester branch office to larger premises at Warsall Road, Northenden, Manchester 22.



Spraying gas liquor on contract; a road tanker fitted with spray bar can carry and spread direct where the ground is sufficiently firm.

GAS LIQUOR TRIAL RESULTS

Reviewed by
F. CLIFTON
SHERRIFF

A summary of experiments by the N.A.A.S. to compare gas liquor with sulphate of ammonia when applied at equivalent rates.

TWO industries have waited quite a long time to learn the results of the official Ministry of Agriculture experiments started several years ago to compare the effect of gas liquor with that of sulphate of ammonia when applied at equivalent rates. Now that they are available they will be studied with considerable interest by the two principal industries concerned.

It must be remembered that to be in the slightest degree reliable agricultural research must cover a period of years in order to 'average out' the vagaries of our British climate. Indeed, many may feel that even the three years covered by these trials are scarcely long enough to provide a final answer and that a five-year cycle would be more conclusive. Nevertheless, they provide a valuable guide.

The results, which were published in the March issue of the Ministry's official journal, *Agriculture*, embraced 28 separate experiments in different parts of the country on grassland, nine experiments on cereals, and 15 on kale. The figures were collated by Mr. J. Webber, of the Yorks and Lancs Province, N.A.A.S. With these results I am incorporating in their appropriate place two further short-term experiments carried out by the N.A.A.S.—one on this farm in Hampshire and the other near Salisbury in Wiltshire.

Mean Responses

In the main experiments on grassland liquor was applied at two rates—300 and 600 gal. per acre, which at 10-oz. strength are equivalent to 2.3 and 4.6 cwt. per acre of sulphate of ammonia, respectively. Taken over the whole series the mean responses to gas liquor, expressed as percentages of the responses to sulphate, were, in terms of dry grass per acre, as under:

Rate gal. per acre	Gas Liquor	Sulphate of Ammonia
300	42	100
600	21	100

In 1954 and 1955 liquor applied in January and February was compared with similar dressings applied in March and April at 18 different centres, and the following dry grass yields (in cwt. per acre) were obtained:

Year	No. of Centres	Treatments (gal. per acre liquor)				
			Jan.-Feb.		Mar.-Apr.	
		Nil	300	600	300	600
1954	13	35.2	41.2	46.4	39.9	39.3
1955	5	26.6	32.1	33.1	33.7	31.5
	18	32.8	38.6	42.7	38.2	37.1

The comparison of the results obtained at the two dates of application is brought out more clearly if the response to the gas liquor is given as a percentage of the response to equivalent dressings of sulphate of ammonia in the same trials:

Rate gal. per acre	Gas Liquor		Sulphate of Ammonia
	Jan.-Feb.	Mar.-Apr.	
300	54	50	100
600	73	32	100

The effect of winter dressings of liquor was shown to be less variable than that of spring dressings, which suggests that the scorching causes a more serious setback to vigorously growing grass than to more dormant plants and that liquor should not be applied, for maximum effect, during the spring flush. In none of these experiments was the yield of grass reduced, although usually the increases obtained were well below those from equivalent dressings of sulphate of ammonia. Mr. Webber formed the impression that there was some loss due to evaporation and leaching. Tod and Simpson's results ('GAS JOURNAL' 1955, 281, 857) confirm that even under the best conditions the efficiency of nitrogen applied as gas liquor is only about 70-75% of that applied as sulphate of ammonia.

At this point it is appropriate to give, very briefly, the results of my own experiments with winter dressings, in which con-

nection I must gratefully acknowledge the help provided by Mr. W. G. Gwynne, Grassland Officer, and Mr. G. W. Woodrow, District Advisory Officer, of this Province of the N.A.A.S.

In case anyone tries to compare the grass yield results with those in Mr. Webber's trials, I must explain that in this instance the cuts were made quite early in the season—before the full spring growth had taken effect—i.e., on April 10 of this year. The figures do, however, give a clear comparison with sulphate of ammonia in relation to the production of early bite.

The experiments were carried out on a vigorous ley of Cockle Park type, in its second year with plots of 16 yd. by 6 yd., randomised with two replications; and the rates of application were equivalent to 400 gal. per acre of liquor and 3 cwt. per acre of sulphate of ammonia. The dressings were put down during the first week in each month November —March inclusive, and in no instance was there any marked scorching.

	Dry Matter— lb. per Acre					
	Nov.	Dec.	Jan.	Feb.	Mar.	Control
Gas liquor	641 (−18%)	956 (23%)	951 (22%)	1,200 (55%)	893 (15%)	778
Sulphate of ammonia	1,464 (88%)	1,421 (83%)	1,375 (77%)	1,619 (108%)	1,731 (123%)	

The only suggestion I can make for the rather extraordinary result of the liquor in November is that it happened to be the only one of the five applications made in dry weather and that the dressing gave the still strongly growing grass a setback from which it did not recover before growth virtually ceased for the winter. When the subsequent applications were made growth had largely ceased, and the check was less serious in consequence. These trials suggest that February is the best month to put down gas liquor for early bite, whereas sulphate of ammonia does not appear to reach its optimum effect until March.

Rapid Recovery

Nine experiments on cereals are recorded by Mr. Webber—mainly on winter wheat. The dressings were applied on various dates from March to May, and in all cases the plots were combined at harvest time. The gas liquor in most instances produced slight scorching, but recovery was usually rapid. The average yields in cwt. per acre were as follows:

No Nitrogen	Gas Liquor		Sulphate Equivalent	
	200 gal.	400 gal.	200 gal.	400 gal.
24.1	26.9	27.8	28.1	29.5
As % of sulphate	70	69	100	100

In its application to cereals the scorch problem does not seem to be as serious as with grass; and in none of the experiments was there any lasting adverse effect on the crop because of it.

Kale is a crop requiring high dressings of nitrogen to obtain high yields; and 15 experiments were carried out with gas liquor at 400 and 800 gal. per acre in comparison with sulphate of ammonia at the equivalent rates of 3.1 and 6.2 cwt. per acre. On most of these experiments the fertilisers were applied a week or more before drilling, and the yields, in tons per acre, were as under:

Year	No. of Centres	Treatment				
		No Nitrogen	Gas Liquor	Sulphate of Ammonia (equal to)		
			400 gal.	800 gal.	400 gal.	300 gal.
1953	7	20.0	23.6	24.8	24.0	24.3
1954	4	11.7	15.0	15.3	15.0	16.5
1955	4	14.8	18.8	22.0	20.1	22.1
	15	16.4	20.0	21.5	20.6	21.6

It will be noted that in these experiments the two fertilisers gave almost identical results.

Inasmuch-as in these experiments the fertilisers were applied prior to sowing, the effect of gas liquor as a weed control could not be assessed; and for this reason I would like to include here the results of some further independent trials which I witnessed at Salisbury this year. I am indebted to Mr. R. E. Rogers, District Advisory Officer, Wiltshire A.E.C., who supervised these experiments, for the following very striking figures:

Treatment	Tons per Acre
330 gal. per acre gas liquor (2-4 leaf stage)	8.9
660 " " " " " " "	14.3
50 " " " " (low-volume sprayer)	2.8
Control (no dressing)	2.75
Maincrop (tractor hoed and top-dressed with 4 cwt. of sulphate of ammonia, 6-leaf stage)	13.15

The two heavier dressings were put on with standard liquor spraying equipment with splashboard fitted beneath the nozzles. The 50 gal. per acre application by low-volume farm sprayer (of the kind used for selective weed-killers) showed no effect whatsoever either on the weeds or the kale.

At the time of the dressings there was a very heavy weed infestation—chiefly charlock and fat hen. The 660-gal. application gave practically complete control of everything except the kale, while the 330-gal. application gave almost complete control of charlock and a very useful control of fat hen (60-70%). The weeds not killed were severely checked. The effect on the kale also appeared severe—somewhat similar to that produced by the more usual sulphuric acid treatment, but there was quick recovery. In the 660-gal. plots the kale was checked, and there was slight thinning of the crop. There was also some damage by the double wheels of the spraying tanker, and it appears desirable that this kind of work should be carried out by lighter, single-wheel equipment of the bowser type.

The samples were taken on November 26 last, and it is interesting to note that until October the 330-gal. plots appeared best by reason of the fact that there was hardly any initial check. Thereafter, the 660-gal. plots seemed more vigorous. As a result of these experiments, Mr. Rogers takes the view that probably around 500 gal. per acre is the best level of treatment.

The important point to be noted in these weed-control experiments is that the farmer gets two jobs done for the price of one—namely, a generous dressing of nitrogen and an almost complete control of weeds for about £4 per acre inclusive of application. Many selective weed-killers cost at least this amount on their own.

What conclusions can be drawn from all these exhaustive trials? First, it is clear that on the basis of equivalent dressings of nitrogen, sulphate of ammonia, save on kale, is generally more effective. On grass and cereals liquor was from two-thirds to three-quarters as effective as sulphate; but in most of these experiments no account was taken of what I may term the ancillary factors such as weed-control (which is also noticeable on grass and cereals), the possible control of harmful organisms such as slugs, wireworm, and those which cause husk and liver fluke, and the beneficial effect of an alkaline dressing as distinct from an acid one, thereby probably saving, over a period, an additional application of lime to the ground—not to mention the advantage of a liquid dressing being taken up more readily by the plant in dry weather when granular and crystalline fertilisers may lie useless on the surface for weeks.

Financial Comparisons

So much for the practical comparisons. When we come to the financial comparisons we find that sulphate of ammonia at £21 per ton (gross) costs, for a 3 cwt. per acre dressing, 63s. per acre in material alone, whereas gas liquor at the equivalent rate of 400 gal. per acre at £7 10s. 0d. per 1,000 gal. costs 60s. *in the ground*. But to the initial cost of sulphate of ammonia must be added many other items, some easily assessable, some not, but all nevertheless to be reckoned with—for example, cost of storage and handling on the farm (possibly sometimes also handling from rail truck to farm), a share in the capital cost and/or depreciation and wear and tear of tractor and distributor, tractor fuel and oil, time and cost of lubricating and cleaning distributor, spreading cost with labour at not less than 3s. per hour, and so on. All these things may well add another 10s. to 12s. per acre to the cost of sulphate of ammonia in the ground. So there is not, after all, so very much to choose between the two forms on a purely cost basis—and

there are the additional advantages on the side of gas liquor of the factors mentioned in my previous paragraph.

Nevertheless, and let us make no mistake about this, gas liquor will not sell itself on the results of these trials alone. Few farmers having seen the foregoing figures as they stand—and a large number will have done so—will feel inclined to abandon the traditional forms of nitrogenous dressings in favour of gas liquor. It is the ancillary advantages of liquor which turn the scales in its favour.

My own view is that if the gas industry seriously wants to dispose of more liquor in this way, and so help food production in this country, it will have to take a much greater interest in this product than it has generally displayed up to now. It must undertake more research and experiment; it must consider ways and means of providing liquor more cheaply and transporting it more cheaply; and, most important, it must go out and sell it to the farmer in just the same way as it sells domestic appliances to the housewife. It is not enough to quote a price ex-works and leave everything else to the contractor. The latter, as a rule, has a lot of other irons in the fire and is not necessarily only interested in gas liquor.

To conclude, I would quote Mr. Webber's own comment on the subject (the italics being mine): 'Gas liquor is a virtually untapped by-product of the gas industry which, as N.A.A.S. experiments show, might be very useful as a nitrogenous fertiliser *if it can be made available to the farmer cheaply.*'

THE GAS-FIRED PACKAGED AUTOMATIC BOILER

THE packaged automatic boiler was originally developed in the U.S.A., where, of course, it usually has to be capable of firing on oil or natural gas. In this country, because there is virtually no natural gas, the majority of packaged boilers supplied since they were first available on a large scale at the beginning of 1955 are oil-fired. There are, however, a number of gas-fired installations. The two basic reasons for using gas on any scale in boilers are: (1) Availability of gas at a reasonable cost (due perhaps to the existence of a preferential rate for large bulk users); and (2) where local by-laws do not permit the use or storage of oil fuel.

A typical packaged boiler, several examples of which are at present gas-fired, is the Powermaster manufactured by G.W.B. Furnaces, Ltd., of Dudley. It is said to have all the advantages associated with packaged boilers, notably automatic operation, compactness, smoke-free operation and ease of installation. Another outstanding feature is the fact that the responsibility for supplying the complete unit, including ancillary equipment rests with the one manufacturer. The boiler is fire-tested before despatch.

The Voriflow Burner

The Voriflow burner, with which the Powermaster is equipped for gas-firing, is of the pre-mix design in which the gas flows to the central nozzle from the gas plenum. Simultaneously, combustion air from the blower enters the air plenum, automatically controlled by the motor-operated damper. Primary pre-mix air is captured by a stationary air-wheel register. This assembly directs the pre-mixing air through holes into the gas nozzle against venturi shaped air baffles. The air and gas are thoroughly mixed on their way through the gas nozzle. The outer secondary air ring controls the amount of secondary combustion air admitted to the combustion chamber. Ignition takes place at this point. The diagram (Fig. 1) of the Voriflow gas burner illustrates this process.

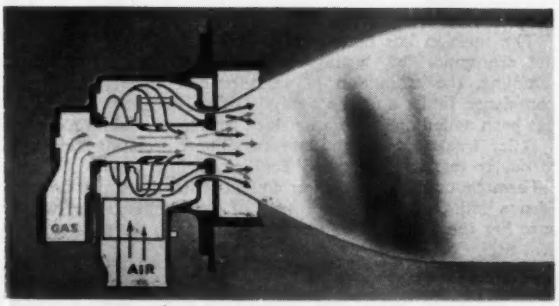


Fig. 1. Cross-sectional view of Voriflow gas burner.

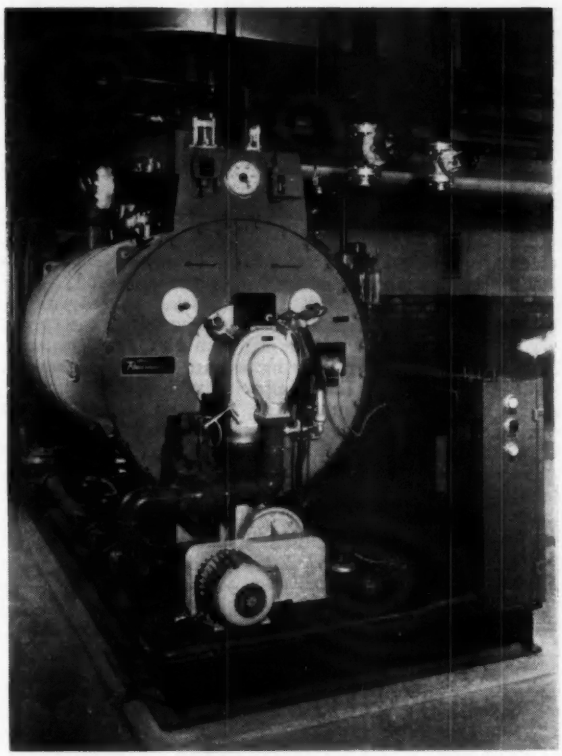


Fig. 2. Model 50 gas-fired Powermaster burning 450 c.v. gas at the works of Edgar Allen & Sons, Ltd., Sheffield.

The Powermaster

The boiler shown in Fig. 2 is a Powermaster Model 50 rated at 1,725 lb. of steam per hour from and at 212°F., the working pressure being 100 lb. per sq. in. The unit is installed at the Sheffield works of Edgar Allen & Co., Ltd., and serves the new foundry welfare centre. The boiler is of three-pass design in which the burning gases pass down the central main tube and reverse towards the front through the lower bank of fire tubes, then reversing once more through the two upper parallel banks of tubes to the rear of the unit and out through the fume outlet. A specially shaped refractory throat is fitted at the burner end of the combustion chamber, and the rear

chamber where the gas is reversed is insulated by a brick-lined rear cover and a refractory arch. The back plate of the boiler can be swung out for periodic inspection of the tubes. An operational test report on this particular unit is set out in this article.

OPERATIONAL TEST REPORT ON POWERMASTER BOILER FOR EDGAR ALLEN'S FOUNDRY WELFARE CENTRE.

Model No. 50 W.P. 100 lb. per sq. in.
Gas fired with Town Gas of 450 B.Th.U. per cu. ft. calorific value.—Duration of test 4 hours test house temperature 50°F.

Performance checked	High fire	Low fire
Gas consumption, cu. ft. per hour	4,200	1,380
Air pressure—plenum, in. W.G.	5.0	5.0
Gas pressure before shut off, in. W.G.	6.4	7.4
Gas pressure before regulator, in. W.G.	6.2	7.3
Gas pressure after regulator, in. W.G.	3.3	3.8
Gas pressure after solenoid valve, in. W.G.	2.7	3.6
Gas pressure at burner, in. W.G.	1.8	0.4
Gas pressure at pilot, in. W.G.	6.4	6.4
Air pressure at pilot, in. W.G.	6.0	6.0
Steam Generated—lb. per hour	1,725	345
Steam pressure—lb. per sq. in.	80	80
CO_2 content of flue gas, per cent.	11.5	11.5
Stack temperature—deg. F.	440	340
Smoke reading—Ringelmann scale	No. 1	No. 1
Calculated combustion efficiency—per cent.	83	83

There are 17 standard models of Powermaster boiler available, ranging in output from Model 15 with a capacity of 500 lb. per hour up to Model 500 with a capacity of 17,250 lb. per hour. All but the smallest two models are fitted with the Voriflow burner, which is fully modulating, giving the correct gas/air firing ratio when working from 20%-100% capacity, modulating the firing rate in accordance with the demands made on the boiler. The smallest units, Models 15 and 30, have a simple on-off control. Fig. 3 shows a Model 15 which was supplied to a unit-type cleaning shop of Achille-Serre, Ltd., at Waltham Cross. Here, local regulations forbade the use of an oil-fired boiler. The unit is turned off at night and is said to take only some 25 minutes in the morning to generate the required steam. It will be seen how the compactness of the boiler enables it to be fitted into a corner adjacent to the steam-using equipment.

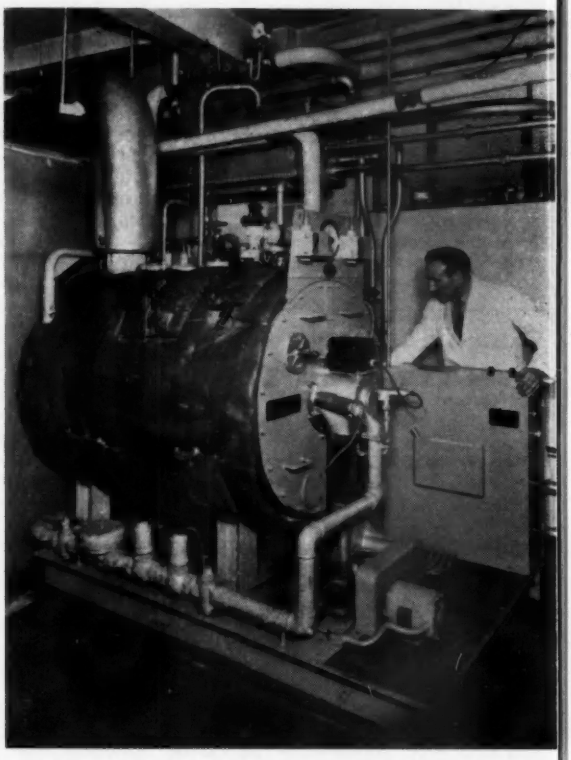


Fig. 3. Model 15 gas-fired Powermaster working in a dry-cleaners.

Another interesting type of this boiler is fitted with a combination oil/gas burner which permits the immediate conversion from one fuel to the other without any complex changes in piping, wiring or other accessories or components.

NEW BOOKS

Fundamental Coal Research

COAL SCIENCE—ASPECTS OF COAL CONSTITUTION, by D. W. van Krevelen and J. Schuyer (Elsevier Publishing Company).

WITH the energy famine in Europe and indeed to some extent throughout the industrial countries of the world, the need for fundamental research on coal structure and its constitution continues to attract more and more attention. In fact, so great have been the advances in fundamental coal research over the last 15 years that it is of importance to note that this branch of scientific investigation has now assumed the dignity of a separate name—'coal science.' It is, therefore, of considerable interest that the authors, both working in the central laboratory of the Dutch State Mines at Geleen in the Netherlands should publish this book which contains not only an account of much of their own research, but an objective view of the latest knowledge on this particular subject.

The book, which makes no claim to be an exhaustive survey of subjects treated in it, is divided into three parts: First a consideration of coal from the points of view of technology, geology, petrology, chemistry and physics; secondly an account of its statistical constitutional analysis and its present structural picture; and thirdly an account of its physical and chemical properties, not included in the second part.

At the end of each part the authors give a critical view of the work done and ask what progress has been achieved in the attempts to elucidate the complexities in coal constitution.

EXTENSIVE REVISION

STATISTICAL METHODS IN RESEARCH AND PRODUCTION—with special reference to the Chemical Industry. Third edition revised. Edited by Owen L. Davies. (Published by Oliver and Boyd for Imperial Chemical Industries, Ltd. Price 45s.)

PREVIOUS editions have established this as a standard handbook of statistical methods for scientific and industrial workers. After the first edition was published in 1947 a sequel dealing with the planning of experiments and entitled *The Design and Analysis of Industrial Experiments* was written and first published in 1954 by a team of scientists similar to that responsible for the writing of this book. Further advances in theoretical statistical methods and their application to industrial research, together with the additional experience gained in industry, have made it necessary to revise completely the original edition and every opportunity has been taken to bring the third edition completely up to date.

The revision has been most extensive. New topics include the economics of testing and experimentation, sequential sampling, the estimation of variance components and their confidence limits and the analysis of co-variance. A chapter has been added on the relationships between variables to permit a fuller treatment of multiple curvilinear, relationships with particular reference to the difficulties of interpretation.

Throughout the new edition emphasis has been put on confidence limits in preference to tests of significance, since experience has shown that the former possess much the greater practical utility.

Such methods of analysis are now being applied to other industries besides the chemical industry and with the employment by many of the area boards of mathematical statisticians this book will now have an even wider appeal.

From a paper to the Northern Junior Gas Association

The Infection of Purifier Oxide by Bacteria and Other Organisms

By B. RICHARDSON, F.R.I.C., M.Inst.Gas E.,
NEWCASTLE UNIT, NORTHERN GAS BOARD.

THE evolution, through bacterial action, of traces of hydrogen sulphide from a purifier box placed last in series is recognised as being possible under certain conditions. Recently it was noted during an investigation into a case of hydrogen sulphide 'throw-off' during the passage of clean gas through the final box of a line of oxide purifiers. This occurred at the Workington station of the Northern Gas Board where a supply of crude coke-oven gas was being dealt with in two separate purifier sections operating on the 'downward flow' system. One of these sections consisted of overhead boxes, and the other of boxes erected in a pit, partly above and partly below ground level. It was only in the latter or 'A' section that traces of hydrogen sulphide were being 'thrown-off' for the gas at the outlet of the overhead boxes was invariably found to be clean, whichever unit happened to be last in series.

Careful testing showed conclusively that the trouble originated within the boxes themselves. They were filled with preparations of oxide artificially rendered porous by the addition of a proportion of wood chips or sawdust, and these mixtures had hitherto behaved in exemplary fashion. Samples of the drainings taken from the boxes immediately after 'throwing-off' of hydrogen sulphide became apparent were found to contain small amounts of thio-carbonates formed presumably as the result of inter-action between ammonium sulphide and carbon disulphide vapour.

$$(NH_4)_2S + CS_2 = (NH_4)_2\,CS_3.$$

Such compounds, it is held, are liable to be decomposed by carbon dioxide with the evolution of hydrogen sulphide, and it was thought that the traces of this impurity found in the gas from the 'last taker' boxes might conceivably be attributed to this cause. However, since the admission of ammonia to the purifiers had been completely discontinued for some time, and because a sample of the affected oxide was found to contain only 0.11% of ammonia by weight, this explanation did not appear to be feasible. For the same reason the presence of ammonium sulphide sludge could be ruled out, and apart from this it was stated that the space below the bottom grids had been thoroughly swilled-out with water on more than one occasion after the trouble began.

Incubation Period

The writer then suggested that the production of hydrogen sulphide might be due to the activity of bacteria in the oxide of a type capable of converting free sulphur or sulphates into this compound. An affected batch of the oxide did not begin to 'throw-off' hydrogen sulphide until it had been in commission for some days which seemed to indicate a period necessary for incubation.

Last August No. 4 box of the 'A' section from which when in last position the gas had been picking up hydrogen sulphide to the extent of 28 parts per mill. was taken out of circuit and emptied. Nothing abnormal was noticed until the bottom layer was reached. There a small portion of the oxide occupying a volume of about 1 cu.ft. immediately above the bottom grid was found to be warm. It gave off an objectionable odour, and when exposed to the atmosphere heated up and evolved steam. A closer examination of lumps of this oxide revealed the presence of mould subsequently identified as *Pullularia Pullulans* mixed with *Penicillium*. The former is a fairly common mould occurring particularly on damp cellulosic materials. Underneath the bottom grid of the box and on the bottom plates of the box itself further quantities of the white mould were discovered growing on a layer of what may best be described as a black jelly-like material which possessed a peculiar and foetid odour.

Samples of both the mould-infected oxide and black 'jelly' were examined in the laboratory. Ten grams of each were sealed up with air in separate flasks, a piece of filter-paper soaked in lead acetate solution being also suspended in the flasks, which were then completely immersed in a thermostatically-controlled water-bath set at 100°F.

A white 'fur' of mould began to appear upon the surface of the moist oxide after the first few days and steadily spread until it had covered a considerable area. On the fourth day the strip of lead acetate paper developed a brown tinge around the edges, and after ten days the whole of the surface of the paper had turned a very pale brown. At this point the flask was removed from the water bath and on analysis its contained residual air was found to possess the following percentage composition by volume.

	%
CO_2 —	8.5
O_2 —	10.5
N_2 —	81.0

The foetid black jelly showed an immediate absorption of oxygen on being placed in the bath, but no 'fur' or mould. The suspended lead acetate paper turned a uniformly brown colour after three days, and at the end of six days an analysis of the residual air showed it to contain 11.6% of CO_2 and only 9.2% of oxygen. These experiments proved that the partially-spent oxide harboured living organisms, and it would seem that the small amount of hydrogen sulphide evolved might, conceivably have been derived from the putrefaction of organic matter. The black 'jelly' appeared to consist of masses of dead organisms associated with iron oxide sludge, free sulphur, and a trace of ammonium salts.

The flask experiments with the same samples of oxide and 'jelly' were then repeated in an atmosphere of purified coal gas instead of air. At 100°F. it was found that the lead acetate paper in the flask containing the oxide sample turned dark brown after 17 hours. Five hours later it was completely black, but there was no mould growth. The black 'jelly' reacted similarly only more vigorously, for the lead acetate paper became tinged a few minutes after the flask had been immersed in the water bath and turned jet black after 24 hours. During this period growths of mould began and an extensive white 'fur' developed on the surface of the 'jelly.' After one day the experiment was stopped and a strong odour of hydrogen sulphide was found on uncorking the flask.

The results of analysis of the residual gases from the two flasks were:—

		Coal gas used for filling flasks.	Residual gas from affected oxide flask.	Residual gas from flask containing 'jelly.'
		%	%	%
CO_2	—	2.0	6.2*	7.6*
O_2	—	0.4	Nil	Nil
Cn Hm	—	1.9	1.8	2.0
CO	—	6.2	5.2	5.0
CH_4	—	22.6	23.9	23.9
H_2	—	54.0	49.2	48.9
N_2	—	12.9	13.7	12.6

* Includes Hydrogen Sulphide.

Samples of the contaminated oxide and black 'jelly' were forwarded to the Teddington chemical reesarch laboratory of

the Department of Scientific and Industrial Research where they were examined for the so-called sulphate-reducing bacteria. As a result it was found that both contained at least 10^6 such bacteria per gram, which is a very high figure and suggests that under suitable conditions, as for example lack of oxygen (these bacteria are anaerobic), presence of sulphur or sulphates, moisture, and suitable nutrients, sufficient hydrogen sulphide might be generated in the last box of a purifier line to escape absorption and cause the gas to fail to comply with the Official Purity Regulations.

The tests were next repeated with a fresh sample of the prepared oxide of the type which had been used in the boxes when 'throwing off' had been experienced. The material was first confined in a flask with air and maintained at a constant temperature of 100°F. for one week. No visible mould-growth took place and no trace of hydrogen sulphide was evolved but analysis of the residual air at the end of the experiment showed the presence of 3.6% of carbon dioxide, probably the result of oxidation of damp organic matters (sawdust and wood shavings) in the sample.

When the same new oxide was left for the same period of time in an atmosphere of town's gas instead of air a more vigorous action ensued, and a greyish-white patch of mould spread over the surface of the oxide during the first three days. Strips of damp lead acetate paper suspended in the flask turned pale brown after one day, and the shade progressively deepened until at the end of the week it was deep brown. The residual gas in the flask showed an entire disappearance of oxygen, a diminution in the hydrogen content, and an increase in carbon dioxide. This specimen of unused oxide was also examined at the Teddington chemical research laboratory where it was found that a high concentration of sulphate-reducing bacteria developed after an incubation period of three weeks.

Next, a portion of affected partially-spent oxide containing about 17% of free sulphur and 3.6% of sulphate sulphur was sealed in a flask with nitrogen and placed for a week in a water bath maintained at a tempertaure of 70°F. No mould growth was apparent but after a few days a lead acetate paper suspended above the oxide turned almost black showing that the production of hydrogen sulphide was taking place at a comparatively rapid rate under anaerobic conditions, indicating the presence of active sulphate-reducing organisms in the material.

Exactly the same phenomena were noted when a fresh sample of an artificial oxide preparation was sealed up with nitrogen, which is, however, what one might expect having regard to the fact that this material was found to contain over 1% of sulphates calculated as SO_3. Samples of new natural bog ore which were free from added sawdust and sulphates, were shown under similar test conditions to evolve no hydrogen sulphide after nine days exposure to nitrogen, but it was found they did so if 1% by weight of either ferrous or calcium sulphate were introduced. These experiments show that sulphate-reducing bacteria are present in untreated natural bog ores as well as in artificial preparations but in the former case they exist in a more-or-less dormant condition until presumably, the stimulus of a suitable environment awakens them into activity.

Widely Distributed

Sulphate-reducing micro-organisms are very widely distributed in nature. They are single-celled creatures about one micron wide and four microns long provided with a flagellum, but they vary considerably in appearance. One variety, for example, assumes the form of a spiral which may be as much as 100 microns long, while another variation is distinguished by the possession of two or more flagella. These bacteria require moisture and anaerobic conditions. If such an environment is not available they do not die, but fall into a quiescent condition of 'suspended animation' for prolonged periods, or until such time as changes in their surroundings stimulate them once again into active life. Sulphate-reducing organisms—*Desulphovibrio Desulphuricans*—are capable of reducing sulphates to sulphides, oxygen being set free in the process which may be used in oxidising organic matter in the vicinity. Energy is thereby absorbed but if the liberated oxygen subsequently unites with hydrogen or an organic nutrient material an actual *net release* of energy will, in effect, take place. The disappearance of hydrogen from coal gas which has been allowed to remain in contact with infected oxide and to which attention has already been drawn is most probably due to this cause.

It is now necessary to attempt an interpretation of these laboratory results and ascertain how far they provide a clue to the Workington trouble. The experimental work showed that new oxide (natural and artificial) will not evolve hydrogen sulphide under normal conditions when sealed up in a flask with air. If, however, the oxide contains a proportion of partly-decayed sawdust or wood shavings infected with mould, growth of the latter will take place and in consequence oxygen will progressively disappear until its concentration falls to that which will allow sulphate-reducing bacteria to become active. These organisms can then give rise to traces of hydrogen sulphide by attacking and reducing sulphates which are usually found in brands of prepared oxides. In an atmosphere of town gas, mould growth will soon entirely eliminate its small oxygen content and create conditions favourable for the development of anaerobic micro-organisms.

Partially-spent and infected oxide from the No. 4 'A' section box at Workington apparently reacted in this manner when sealed in a flask with coal gas, but on the other hand, the same material (which contained 17% of free sulphur) began to evolve hydrogen sulphide in air even when there was more than 10% of oxygen present, so that in this particular instance the hydrogen sulphide would seem to have originated from some source other than sulphate-reducing bacteria.

Due to Putrefaction

Again the foetid black 'jelly' to which reference has already been made on an earlier page, evolved hydrogen sulphide in an atmosphere containing 9% of oxygen but it produced much more and at an accelerated rate in oxygen-free coal gas, so that in this instance it is probable that much of the hydrogen sulphide given off in air with an excess of oxygen present could be attributed to putrefaction of organic matter, while the agents responsible for its evolution in coal gas were anaerobic bacteria. The establishment of an anaerobic environment for bacteria in the Workington purifier boxes would appear a matter of some difficulty when it is remembered that at the time the trouble was at its height the gas, on the average, contained 1.4% oxygen at the inlet to the purifier lines and 1% at the outlet.

It is, of course, conceivable that oxygen concentrations of this order are not too high to inhibit their activities or alternatively it may be permissble to assume that anaerobic pockets may exist above the purifier grid bars and elsewhere in the boxes. The accumulation of black jelly-like substance found on the bottom of the No. 4 'A' section box at Workington was, indeed, covered by a tough leather-like skin on which flourished a thick layer of white mould so that the material lying beneath it would, in all probability, be almost entirely excluded from oxygen. After weighing all the available laboratory and works evidence the final conclusion reached was that the hydrogen sulphide 'throw-off' originated with the growth of mould in the oxide, the flow of gas through the boxes providing the continuous supply of oxygen necessary for its existence. It was established that the mould could live in crude coal gas containing up to 1½% of hydrogen sulphide by volume, so once growth had started rotation of the boxes would not necessarily arrest it. It is also significant that oxide samples which were not infected by mould but, nevertheless, contained a high concentration of sulphate-reducing bacteria gave rise to no trouble, whereas all oxides responsible for hydrogen sulphide 'throw-off' could be made to grow luxuriant crops of *Pullularia Pullulans* under appropriate conditions.

For example several samples of partially-spent oxide obtained from both gasworks and coke-oven installations in the area of the Northern Gas Board were examined. In no instance had any of these behaved other than normally in the purifiers, yet all of them were found to contain quantities of sulphate-reducing bacteria. On the other hand they were quite free from mould, but the addition to them of small amounts of infected Workington samples soon produced a vigorous growth, and they evolved traces of hydrogen sulphide when confined with coal gas or nitrogen in sealed flasks maintained at a constant temperature of 80°F.

The probability then is that on the works scale the sulphate-reducing organisms in the majority of cases can only play a secondary role in hydrogen sulphide 'throw-off' phenomena as the conditions suitable for their activities which demand the absence of oxygen, are realised very occasionally in practice.

The principal cause for the generation of hydrogen sulphide in the Workington purifiers would, therefore, appear to be the putrefaction of organic matter present as sawdust or wood chips in the oxide, and of mould growing on the latter. Putrefaction is particularly liable to take place if the sawdust or other cellulosic matter artificially added is in the first instance partly-decayed and mould-infested. When mixed with oxide such material will tend to ferment and so bring about a rise in temperature in the heap, infection by spores of mould identical with, or similar to, *Pullularia Pullulans* having already occurred.

If oxide in this condition is filled into a purifier and subjected to the action of gas containing up to 1% or more of oxygen, fermentation and mould-growth will persist, especially if the temperature in the oxide mass is maintained at 80-90°F. In such an environment successive generations of mould may well develop, flourish, and decay, their putrefying remains being continually washed down into the bottom of the boxes along with oxide dust, free sulphur, rotting sawdust and other debris. The final result would be the black 'jelly' which was found in the No. 4 'A' section purifier at Workington and which provided an ideal medium for the propagation of still more mould. When the box was placed in the position of 'last taker,' the whole of the pullulating deposit would tend to evolve hydrogen sulphide and contaminate the clean gas as the latter swept over it on its way to the outlet. Sulphate-reducing bacteria may also have played their part where the organic matter in the oxide might give rise to local reducing conditions by absorbing free oxygen but for reasons already adduced it is believed that their role—at Workington at least—was a minor one.

Avoiding Infection

To prevent such trouble occurring in the first place, it is essential to ensure that the quality of the sawdust or wood shavings added to the oxide should be fresh and dry. However, if a satisfactory type of material is not forthcoming then some form of bactericide should be added to the oxide or purifier box. *Desulphovibrio Desulphuricans* can, it is said, be killed or rendered inactive by substances such as chlorates, permanganates, chromates, and dichromates. Salts of copper, zinc, cobalt, mercury, and silver as well as tannates and certain dyestuffs are also stated to be efficacious. At Workington, the reagent tried in the first instance was sodium chromate, and a solution of this was introduced into the bottom of a purifier which, while in the position of last taker had been evolving strong traces of hydrogen sulphide. Although the whole of the space under the grids was flooded with the chromate no permanent cure was effected.

In view of this negative result no further large-scale proceedings were taken until a number of laboratory experiments had been carried out involving the use of copper sulphate, naphthalene, and phenol. To begin with a badly-infected oxide sample was treated with about 0.5% by weight of copper sulphate, one portion of this was placed in a sealed flask with air and another in a similar flask filled with coal gas (oxygen content 0.6%) and immersed in a water bath maintained at a constant temperature of 100°F. for one week. During this period the oxide in contact with air showed no sign of mould. No hydrogen sulphide was given off but when the residual air in the flask was analysed it was found to contain 2.4% by volume of carbon dioxide, showing that in some manner, oxidation of carbonaceous or vegetable matter had occurred.

In an atmosphere of coal gas this oxide, after five days, began to evolve slight traces of hydrogen sulphide and a white growth of mould simultaneously appeared on the surface. The effect of these developments was to convince us that copper sulphate could not be regarded as a particularly effective sterilising agent. All it seemed to do was to retard rather than prevent the development of mould and the incubation of bacteria in the material.

The efficacy of naphthalene was next investigated by mixing the same oxide with 0.5% by weight of this hydrocarbon and keeping it in a sealed flask with coal gas for one week at a constant temperature of 70°F. No trace of hydrogen sulphide was given off at any time during this period, mould growth appeared to have been completely arrested and the oxygen content of the gas (0.4%) remained unaltered throughout the whole period of the experiment. But when the amount of naphthalene added to the oxide was reduced to 0.25% by weight, and the test repeated, considerable mould-growth took place and appreciable traces of hydrogen sulphide appeared.

Substitution of air for coal gas in these experiments resulted in no sulphuretted hydrogen being produced from oxide containing 0.25% by weight of naphthalene but large quantities of a greenish mould spread over the surface of the oxide with a concurrent reduction of the oxygen content of the air to 3.8%. All this evidence seemed to point to naphthalene being a somewhat better germicide than copper sulphate, although it was not wholly satisfactory. Even if it had been so, the wisdom of adding such a substance to purifier oxide is open to doubt.

A third series of tests was then undertaken, once more on the same infected oxide sample, to which this time 0.25% of phenol had been added. The results demonstrated beyond question that all living organisms were destroyed by this treatment for in atmospheres of coal gas and air, it was impossible to cause mould to grow or to detect hydrogen sulphide. In this respect our experience seemed at variance with a report by Butlin, Vernon, and Whiskin in which it is stated that ordinary disinfectants such as chlorine, lysol, phenol, and sulphanilimides have no effect on killing sulphate-reducing bacteria or rendering them inactive. Following on this work it was decided to 'doctor' a batch of oxide which harboured both mould and bacteria with crude carbolic oil before filling it into a purifier box. The treatment consisted, quite simply, of spreading out the material in a thin layer upon the ground and sprinkling it with the requisite quantity of reagent (20 gal.) contained in a watering can. Since that time there have been no reports of hydrogen sulphide evolution from this particular box, so we feel justified in claiming that a satisfactory answer to the problem has been found. One factor at Workington which may have favoured the growth of living organisms in the purifier oxide is the relative freedom from bactericides of the crude coke oven gas supply treated on the works. This normally contains the merest trace of naphthalene and benzole extraction has been carried out so thoroughly that the equivalent of less than 0.1 gal. per 12,000 cu.ft. remains as vapour in the gas. Hence any infected oxide filled into the purifiers would not be sterilised to the same extent as in the case where a gas supply were dealt with containing from 10 to 30 grains of naphthalene per 100 cu. ft. and benzole vapour equivalent to 3 gal. per 12,000 cu.ft. These are the conditions usually obtaining on a gasworks, for dry purification is nearly always carried out prior to benzole and naphthalene removal, the plant or plants for this purpose being, in the vast majority of cases, situated on the purified gas stream immediately before the station meter.

Tentative Theory

The above theory is put forward tentatively only. The enhanced purity of gas has been suggested to account for the higher number of cases reported during recent years of holder tank water contamination due to hydrogen sulphide generated by sulphate reducing bacteria in the water. In particular it is maintained, does this apply to naphthalene, which in the past, before its extraction from town's gas became general, undoubtedly maintained asceptic conditions in the holder tank.

The possibility of micro-organisms present in the Workington oxide producing hydrogen sulphide from carbon disulphide in the gas was also considered, but such an explanation does not appear adequately to explain what took place. Mouldy sawdust, fairly high temperature in the boxes, a suitable degree of humidity and (perhaps) a gas exceptionally free from bactericides are believed to represent the principal factors which bring about the conditions described in the present paper. It is not claimed, of course, that they are applicable to all cases of hydrogen sulphide 'throw-off' because, as is well-known, the phenomenon may arise from several different causes, of which bacterial activity is only one, and an uncommon one at that.

There still remains the problem of providing an explanation to account for the fact that hydrogen sulphide 'throw-off' was confined to only one of the two purifier lines at Workington, namely that built partly above and partly below ground (No. 1 Section). The most natural supposition to account for the apparent immunity of the overhead section boxes is that the temperature of the oxide in these is lower, but temperature conditions in the overhead boxes were found not to differ

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materially from those of the 'A' section line. It would appear that the cause for the immunity of the 'B' line of purifiers lies in the quality of the added sawdust and not to the presence of inhibitors or inadequate temperatures.

DISCUSSION

Mr. J. C. Graham, President, thanked Mr. Richardson and suggested that the test of material in a flask which produced a discolouration of lead acetate paper in 17 hours could be applied to all oxides prior to use to give a check that no offensive bacteria were present. Mr. Richardson replied that any small infection would develop under suitable conditions; the test could always be applied but was not usually necessary.

Mr. R. S. Longhurst questioned whether the oxide was a well known brand, or manufactured by a small and inexperienced firm. The only unusual condition in the boxes was the lack of NH_3 and this might increase the sulphate production, which in itself was not helpful, but he wondered if any investigation was carried out on the activity of the mould at varying pH values. He believed bacteria were active or dormant depending on the pH value of the material in which they survive. Mr. Richardson said the oxide was an artificial product. Careless storage of new oxide could very easily cause rotting of the filler, but the pH values of the oxides in either stream of purifiers were approximately the same.

Mr. P. Lee (Middlesbrough) considered there was room for an investigation into pH values, as in water works practice conditions were only achieved between the range 7.8 to 8.4. He was of the opinion that most putrefaction was caused by sulphate reducing bacteria in the correct atmosphere, at the right temperature, and at the ideal pH value. He asked if chlorine or hypochlorite had been tried as a germicide. Mr. Richardson said pH values of all the oxide examined were determined and were within the range 6.5-8.0. Putrefaction in this case was not caused by sulphate reducing bacteria as these are all anaerobic and H_2S was actually given off by the black jelly-like material in air.

Traced to Leaking Valves

Mr. W. O. Kirkwood (Sunderland) recalled that most traces of H_2S he had found were eventually traced to leaking valves. Contamination could take place from impure water. He remembered a mould on a gas holder tank being traced to the introduction of polluted water. Mr. Richardson said both oxides were delivered to the works as prepared oxides ready for use. Contaminated water could only have been used by the manufacturers of the oxide.

Mr. H. Waiton (Howdon) asked whether the danger of infection was sufficient to warrant the treatment of all boxes and oxide with phenols before use. Mr. Richardson replied that in most gasworks the trouble investigated was unlikely to occur as most gas treated contained naphthalene and benzole, both germicides.

Mr. Sanderson (Newcastle) asked if it was possible to design a plant for CS removal by bacterial action. Mr. Richardson said it was, but there was no need to invoke the aid of bacteria, as a catalytic process was in use in the gas industry which removed the CS_2 from the gas. At Workington the CS_2 was not the cause of the trouble as the H_2S obtained was far in excess of that obtainable from the available CS_2.

Mr. P. Lee (Middlesbrough) suggested the use of sulphur bacteria as distinct from the more annoying sulphate reducing bacteria. Mr. Richardson said this might be possible as the use of peat for purification really worked in this way to a limited degree.

Mr. Buckley (Newcastle) said the black jelly-like substance had apparently never been met before. The problem of how to avoid such a growth seemed to be one of care. Storage of new oxide was often casually undertaken and could possibly introduce moulds. He felt that the use of hessian on steel grids was a possible source of infection as this material rotted. Mr. Richardson agreed that the hessian in rotting could provide possible infection but felt there was no need for alarm in most cases because of the germicidal action of constituents usually present.

Mr. H. Waiton (Howdon) asked if preliminary oil washing of gas before purification would increase the risk. **Mr. Richardson** said he felt the risk was in the preparation of the artificial oxide; good quality sawdust was an essential.

Mr. Buckley (Newcastle) suggested that the reason why two streams of purifiers supplied with similar oxide behaved dissimilarly could be due to the introduction of an inhibitor in one stream. He sugggested the possibility of varying the content of chlorine in town's water in the make-up of the oxide. Mr. Richardson said the boxes had not been initially sprayed as far as he knew. Chemical examination of the box drainage and of the oxides themselves, however, failed to detect chlorine.

Mr. S. Irvin (Newcastle) asked if each parcel of oxide received the same treatment. Mr. Richardson said the manufacturers of prepared oxide could vary their product, but he thought that due to the difficulty of obtaining suitable lightening material, the probability was that the quality of the sawdust varied.

Mr. L. Nelson (Blyth) asked if every box in the stream was affected. Mr. Richardson said the whole stream was affected but one box was considerably worse than the others.

Mr. A. Fothergill (N.C.B.) asked for details of the temperatures of the two streams, and if any explanation could be given for the absence of sulphate reducing bacteria in the oxide of the overhead boxes. Mr. Richardson said the temperatures of both streams of purifiers were similar, and he could not account for the lack of bacteria in the overhead boxes which had been filled with apparently similar oxide and were working under similar conditions. The oxides, however, were, he believed, different batches.

Avoiding Use of Sawdust

Mr. C. Thompson (Newcastle) suggested the use of some other filler than sawdust for the manufacture of prepared oxide. Mr. Richardson said that this had been considered but peat was difficult to mix intimately although charcoal was a possibility and experiments were being carried out in its use.

Mr. J. Lewis (Howdon) asked whether as the activity of the bacteria ceased at 50°F., it would not be possible to destroy them at winter temperatures when new oxide was left out. Mr. Richardson replied that bacteria lie dormant at very low temperatures and it was necessary to heat up to 100°C. for complete sterilisation.

Mr. P. Lee (Middlesbrough) asked if the oxides sent to the D.S.I.R. research laboratory were tested for specific bacteria or several types. Mr. Richardson said the samples were examined for any sulphate reducing bacteria.

Mr. H. Waiton (Howdon) asked what would have been the situation if the boxes had been systematically run on the 'Maynard Formula.' Mr. Richardson said that they had been operated on this formula.

Mr. Henderson (Newcastle) said in his experience on the manufacture of prepared oxide, he had seen cases where the sawdust for manufacture had grown a mould. It was an essential that good quality sawdust was used and machine mixed with the oxide. Such oxide was always despatched immediately and should be used as soon as possible.

Mr. E. W. Robson (Newcastle) suggested that the difference between the overhead boxes and those sunk below ground could easily be due to drainage. It was far easier to get good drainage from overhead boxes. Mr. Richardson said this was a possible contributory factor.

Mr. K. O. Kirkwood (Sunderland) proposed a vote of thanks. He was sure the discussion had illustrated to Mr. Richardson how much his paper was appreciated. Mr. Richardson acknowledged the vote of thanks and said he was grateful for ideas the discussion had given him for further work on the subject.

Report Available

THE report on the opening and industrial sessions of the Joint Conference of the Combustion Engineering Association and the Solid Smokeless Fuels Federation on 'The Application of the Clean Air Act to Private Dwellings and Industry,' held in Birmingham in April, is now available on application to the Combustion Engineering Association, 6, Duke Street, St. James's, London, S.W.1. Price, 15s. to non-members of the Association.

From a short paper to the London and Southern Junior Gas Association, May 3.

Elimination of Carry-over from Coke Quenching Towers

By A. P. PORTCHMOUTH, A.R.I.C., M.Inst.Gas E.,
SOUTH EASTERN GAS BOARD.

THE paper describes work carried out by the South Eastern Gas Board with a view to minimising the nuisance caused by carry-over of water droplets from coke quenching towers. An account is given of preliminary investigations which are compared with those carried out by the Central Electricity Authority in connection with natural draught water cooling towers. The design of a suitable eliminator is described and an indication is given of its effectiveness when installed in the quenching tower of an intermittent vertical chamber installation.

Intermittent vertical chamber and coke oven installations, although desirable plants from the point of view of high thermal yields of straight coal gas, have certain undesirable features when sited in residential areas. One of the main sources of public complaint is the carry-over of water spray and dust from the coke quenching towers. As well as being unpleasant for neighbouring householders such carry-over, being of a corrosive nature, has a deleterious effect on surrounding steel structures. A similar problem with natural draught water cooling towers has been experienced by the Central Electricity Authority and a successful solution employing louvre type baffles has been described in a paper by H. Chilton (*Trans. Inst. Chem. Eng.*, 1952, **30**, 235).

Investigation at Wandsworth

Although the two unit operations, water cooling and coke quenching, are entirely dissimilar it was considered that the nature of the carry-over from each should have some points of resemblance, since the water emission from each comprises water droplets and condensation fog. With Chilton's work as a basis, it was thought that if information could be obtained as to the nature of the droplet carry-over from quenching towers, it should be possible to design a suitable eliminator which would diminish the carry-over to tolerable limits without unduly affecting the draught in the tower. It was first necessary to establish whether there was, in fact, any similarity between the droplet carry-over of the two operations. To this end, preliminary investigations were carried out on a quenching tower at Wandsworth works.

The quenching tower selected for the initial observations handles coke from No. 4 intermittent vertical chamber installation and comprises a steel framework with wooden sides. It is 94 ft. high with a top cross-section of 13 ft. by 13 ft. 6 in. No. 4 I.V.C. plant carbonises about 296 tons of coal a day during which time some 80 charges of 2.6 tons each of hot coke are quenched in the tower. About 995 gal. of water are used during each quenching period which lasts for 90 seconds. Observations were made over periods during which droplets of 70 microns and over were ejected from the tower, this period lasting for about 80 seconds, although a plume of condensation fog continues for a further 40 seconds. Samples and measurements were taken near the centre of the shaft at the beginning, middle and end of the periods, the following observations being recorded:—

(a) Temperature of the ascending vapour,
(b) velocity of the upward current of vapour,
(c) quantity of carry-over
(d) acidity, etc., of the carry-over, and
(e) size of carry-over droplets.

The results obtained during the preliminary investigations are summarised as follows:—

(a) Temperature of vapour.
Beginning of quench period ... ... 66°C.
End of quench period ... ... 60°C.

(b) Velocity of upward current.
Average at beginning of quench period... 14.3 ft. per sec.
Average at end of quench period ... 10.9 „ „
Average over the whole quench period ... 12.6 „ „

(c) Quantity of carry-over.
Water droplets (above 70 microns)—about 35 gal. per quench.
Coke dust—about 4 oz. per quench.

(d) Acidity, etc., of carry-over.
Acidity (to phenol phthalein)—0.06 normal.
Sulphur content—about 12 oz. per quench.

There was evidence of the presence of H_2S, some of which re-acted with SO_2 to form elemental sulphur.

(e) Droplet size.

The size of detectable droplets varied from about 70 microns up to 600 microns, the majority being within the range 70 to 240 microns. On the meterological scale this would correspond to a mixture of mist and drizzle. The characteristics of the droplets are tabulated below:—

TABLE 1.—DROPLET CHARACTERISTICS

	Mean diameter (microns.)	Average weight with respect to a droplet of 100 microns.
Beginning of quenching period ..	383	20.7 times
Middle „ „ „ ..	446	29.3 „
End „ „ „ ..	387	20.8 „
Average for whole period	396	

The mean diameter was that, above and below which, there was an equal weight of water droplets. The weight of a water droplet of 100 microns is 0.523×10^{-6} grammes. It should be noted from Table 3 that about 85% of the weight of detectable carry-over was over 250 microns diameter, of which the largest weight was in the range 350 to 450 microns.

In tables 2 and 3 the results of the preliminary investigation on the quenching tower are compared with those obtained by Chilton for water cooling towers.

TABLE 2

	Quenching towers (S.E.G.B.)	Cooling towers (Chilton)
Average velocity of upward current	12.6 ft. per second	7 ft. per second
Water loading per hour per sq. ft. of tower section	227 gal.	100 gal.
Weight of carry-over per hour per sq. ft. of tower section ..	70–80 lb.	4.3 lb.
Average droplet size	396 microns.	370 microns.

TABLE 3.—DROPLET DISTRIBUTION

Coke quenching towers		Water cooling towers	
Grade (microns.)	Weight in Grade (%)	Grade (microns.)	Weight in Grade (%)
50—150	1.7	0—100	0.6
150—250	14.1	100—200	5.2
250—350	23.5	200—300	16.8
350—450	28.4	300—400	27.8
450—550	16.0	400—500	49.6
550—650	13.0		
650—750	3.3		
	100.0		100.0

The above results show that there is some similarity between

the average size of droplets emitted from both coke quenching and water cooling towers. It should be noted, however, that the emission from the former plant carries an appreciable proportion of droplets of over 500 microns; no doubt this is due to the higher velocity of emission. The weight of carry-over for quenching towers is very much greater than for cooling towers. This also is attributed to the higher velocity of emission as well as to the greater water loading during the quenching operation.

It was considered that the results obtained were sufficiently encouraging to justify designing a suitable eliminator based on Chilton's conclusions. The design selected consists of two layers of louvres 3 in. wide by ¼ in. thick at 2¼ in. pitch inclined at an angle of 70° with a space of about 1 in. between upper and lower layers. A similar design tested by Chilton at a nominal air speed of 7 ft. per second was over 95% effective with a resistance to air flow of 2.4 velocity heads.

Such an eliminator was made and installed in 1954 in the quenching tower pertaining to No. 3 I.V.C. installation at Wandsworth works. This tower was chosen in preference to that previously tested because in the summer of 1954 No. 4 I.V.C. was still gas-making whereas No. 3 I.V.C. was not. The latter was, therefore, the more convenient plant for installing an eliminator. In addition, there had been complaints from a neighbouring bus depôt of carry-over from this particular quenching tower. The eliminator was positioned at a point which provided ready access for cleaning purposes, about two-thirds of the way up the tower which was of the same dimensions (viz., 94 ft. by 13 ft. by 13 ft. 6 in.) as that used for the preliminary investigation.

No. 3 I.V.C. plant carbonises about 252 tons of coal per day, some 68 charges of 2.6 tons of hot coke being quenchéd during this time. The quenching period is again about 90 seconds, the total amount of water used being about 865 gal. per quench giving a water loading of 197 gal. per hour per sq. ft. of tower section.

Further Tests

Before gas-making ceased (*i.e.*—before installation of the eliminator) tests, similar to those made during the preliminary investigation, were carried out on No. 3 I.V.C. quench tower to determine the size distribution and weight of droplet carry-over from this particular plant.

Following installation of the eliminator, further tests were made six months after gas-making had been resumed. Inspection of the eliminator at this time, however, revealed deposits of coke dust adhering to the underside of the baffles. There appeared to be an appreciable restriction to the free flow of steam up the tower, and it was considered that some two-thirds of the free area had been lost. The opportunity was taken, therefore, first, to carry out tests with the baffles in a fouled condition, following which the eliminator was cleaned and the tests repeated. Results were thus available for both clean and fouled baffles and the effectiveness could be assessed for both conditions.

The number and size of droplets was estimated by the use of water sensitive papers and the accuracy of the test, therefore, depended on the number of such papers exposed within the tower. The results were subjected to statistical analysis and although both the mean weight and number of droplets were variable, the accuracy of the test, with a probability of 95%, was reckoned to be ±16% before installing the baffles and ±25% afterwards. It should be noted that to obtain an average which, 19 times out of 20, would be within ±2½% of the true mean, some 1,008 exposures would be required. Limitations of both the number of staff available and time precluded a test on this scale. The results obtained, however, were comparative and were considered to be sufficiently reproducible to constitute a useful measure of the efficiency of droplet removal. The results are summarised in Table 4.

TABLE 4.—CHARACTERISTICS OF CARRY-OVER (No. 3 I.V.C.)

Grade (microns.)	Weight distribution of water droplets		
	Before fitting eliminator	After fitting eliminator	
		Clean baffles	Fouled baffles
	%	%	%
50—150	0.4	1.2	0.6
150—250	8.6	11.7	11.1
250—350	23.1	21.7	27.6
350—450	29.3	21.0	21.1
450—550	18.8	23.0	19.7
550—650	10.7	13.1	13.7
650—750	7.5	5.7	6.2
750—850	1.6	2.6	—
	100.0	100.0	100.0
Mean droplet dia. (microns.) ..	428	429	414
Mean No. of droplets per sq. ft. per sec.	17,280	6,048	
Total weight of droplets per sq. ft. per second*	642,800	146,300	90,700

* The unit of weight used is the weight of a droplet 100 microns. diameter.

More Important

It was originally thought that the baffles would be more effective in removing the larger droplets and that efficiency would be indicated by a shift in the size distribution from larger droplets to small. From Table 4, however, it will be seen that the decreased number and weight of droplets following installation of the eliminator is more important than change in mean size. The efficiency of the eliminator, expressed as the ratio of the weight of droplets retained by the baffles to that carried over before fitting, was calculated to be:—

Efficiency with clean baffles 77.2%
Efficiency with fouled baffles 85.9%

Allowing for all possible errors in testing by taking the least mean total weight before installation, and the highest mean total weight after, the effectiveness of removal with clean and fouled baffles would still be 65.5% and 78.5% respectively. The higher efficiency with the fouled baffles suggests that with closer setting a more effective removal of the droplets could be obtained, but very frequent cleaning would be required in order to avoid excessive blow-back of steam at the base of the tower. The small gain in efficiency would probably not be justified.

Unfortunately no quantitative determinations were made of coke-dust carry-over, but it seems reasonable to assume that the baffles will remove, with a similar efficiency, solid particles of the same size range as the water droplets.

Since installing the eliminator in No. 3 I.V.C. quenching tower precipitation of water droplets in the vicinity has been noticeably reduced. It is also appreciably less than from the similar tower pertaining to No. 4 I.V.C. which has not yet been so equipped. It has not been found necessary to clean the baffles more frequently than about once every four months, this being effected quite simply by hosing down.

The experimental work described, although perhaps not as detailed as one would have liked, has shown that the insertion of suitably designed two-layer louvre type baffles in coke quenching towers can achieve a marked reduction—of the order of 75%—in the quantity of water droplet carry-over. Although facilities were not available at the time to prove it experimentally, it is reasonable to assume that particles of coke dust of the same size range as the water droplets will be removed with similar efficiency. It is hoped, in time, to equip other quenching towers at Wandsworth with similar baffles and to carry out further, and perhaps more detailed, tests when this is done.

The equipment described was fitted to an intermittent vertical chamber installation sited in a built-up area. It is suggested that such eliminators would be equally suitable for coke oven quenching towers. Although the latter plant is usually sited away from built-up areas and hence the nuisance of droplet carry-over is not so likely to be experienced by the general public, there is still the problem of the corrosive nature of the precipitation which will adversely affect steel structures in the immediate vicinity. It is considered, therefore, that eliminators of the design described could be installed in both I.V.C. and coke oven quenching towers with equal advantage.

COAL MINING FORECAST

Mr. J. E. Ridley, in his presidential address to the Association of Mining, Electrical and Mechanical Engineers last week said that advances in electronics and automation meant that before long coal-cutting and loading machines will move along the coal face under remote control.

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APPOINTMENTS VACANT

ENGINEER familiar with the gas and/or coke-oven industry and works practice, who can write clear and concise English, required as assistant to the editor of a monthly technical journal. No. 323, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

GLOVER AND MAIN, LIMITED

GLOVER AND MAIN, LIMITED, gas meter and appliance manufacturers, invite applications for the position of MANAGER of their Dublin Branch. The responsibilities will include the sales of gas meters and may be extended to include the Sales representation of certain of the constituent companies of the Group throughout the whole of Eire.

Candidates, who should not be more than 40 years of age must be of good education and there are excellent prospects for a man of initiative and energy.

The commencing salary will not be less than £900 per annum and the successful applicant shall satisfy the Company's medical requirements, while residence in or near Dublin will be necessary.

Applications should be submitted to the undersigned not later than Monday, July 15, 1957.

A. J. NEWSON,
Secretary.

Glover and Main, Limited,
48, Grosvenor Gardens,
London, S.W.1.

SOUTHERN GAS BOARD

DISTRICT DISTRIBUTION ENGINEER

APPLICATIONS are invited from suitably qualified persons for the new post of DISTRICT DISTRIBUTION ENGINEER in the Southern Gas Board, within the Southampton Region and covering the districts of Winchester, Andover and Whitchurch.

Applicants should preferably hold the Higher Grade Certificate in Gas Supply or equivalent qualification and must have had sound experience of high and low pressure distribution with control of district Personnel.

The appointment will be made within Grade A.P.T. 10-12 (£860-£1,070) of the National Salary Scales for Gas Staffs, and the starting salary will be dependent upon the qualifications and experience of the successful applicant.

The successful candidate may be required to pass a medical examination and, unless already subject to a Pension Scheme by virtue of the Gas (Pension Rights) Regulations, 1950, will be required to join the Board's Staff Pension Scheme.

Applications to be made on special forms to be obtained from the Personnel Manager, Southern Gas Board, 164, Above Bar, Southampton, and returned after completion by July 1, 1957.

NATIONAL COAL BOARD

NORTH EASTERN DIVISION

CARBONISATION ENGINEERS required at Carbonisation Group Headquarters at Sheffield, Rotherham and Wakefield. Salary £575/£1,025 or £900/£1,250 according to qualifications and experience.

Applicants must be fully conversant in the installation and maintenance of modern coke oven and by-product plant. A recognised qualification in engineering is desirable.

Apply to Administrative Officer, Carbonisation Department, Standfield House, Fulwood Road, Sheffield, 10, by July 10, 1957.

DIVISIONAL MARKETING OFFICER (Coke and Patent Fuel), required by the National Coal Board, East Midlands Division for their Marketing Department at Mansfield Woodhouse.

The responsibilities of the post cover the marketing of coke and briquettes produced in the East Midlands Division, which are supplied to the general domestic and industrial markets.

Applicants should have a wide knowledge of coke and its uses and also of the arrangements under which it is sold.

Salary between £1,560 and £2,275 according to qualifications and experience.

Applications giving full details of education, qualifications and experience should be addressed to The Staff Director, National Coal Board, East Midlands Division, Sherwood Lodge, Arnold, Nr. Nottingham, within 14 days.

Envelopes and applications should be marked " S.V. 781."

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Initial Contract three years.

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Residential accommodation will be provided.

Applications, which will be treated in strict confidence, stating full particulars of experience, present position, age and whether married or single to be sent to: No. 326, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

SOUTH EASTERN GAS BOARD

HOME SERVICE ADVISER
KENT SUBURBAN DIVISION

THE successful applicant will be required to conduct demonstrations, give lectures and advise consumers in their own homes in the use and care of gas equipment, initially in the Orpington District.

Applicants must have undergone training for two years at a recognised training college of Domestic Arts and hold a diploma in cookery, housewifery and laundry work.

Salary, 21 years of age and over, £439-£664 p.a. rising to £750 p.a., according to experience.

Applications, quoting reference V10/819 should reach the Personnel Manager, South Eastern Gas Board, Katharine Street, Croydon, within seven days.

(*Classified advertisements continued on page* 754)

APPOINTMENTS VACANT (ctd.)

EAST MIDLANDS GAS BOARD

CHIEF INSTRUCTOR, AREA TRAINING CENTRE

APPLICATIONS are invited for the position of CHIEF INSTRUCTOR at the Board's Area Training Centre at Long Eaton, Nr. Nottingham. The appointment will be made within Group B. (£1,105-£1,265) of the National Salaries Table for Senior Gas Officers, the starting salary depending on qualifications and experience.

Courses are held at the Centre on a range of subjects—including Gas Fitter refreshers, Salesmanship, Distribution, Supervision, etc.—and are attended by all levels of the Board's employees. The base load of instruction is the responsibility of the Chief Instructor and a full-time Assistant Instructor, but visiting specialist lecturers both from within and outside the Board are drawn on as required.

The successful candidate will be expected to have:—

(a) A real interest and experience in teaching;
(b) a good knowledge of the Gas Industry, particularly in respect of utilisation, commercial and distribution matters;
(c) Associate Membership of the Institution of Gas Engineers or technical qualifications of at least the level of a good pass in Gas Technology (Supply);
(d) the ability to manage the Centre and the courses conducted there.

The post is pensionable and the successful applicant will be required to pass a medical examination.

Applications, stating age, education, qualifications, present appointment and previous experience, together with the names of two referees, should be received by the undersigned not later than July 8, 1957.

A. GWYNNE DAVIES,
Secretary.

Beverley House,
University Road,
Leicester.

June 12, 1957.

EAST MIDLANDS GAS BOARD

LINCOLNSHIRE DIVISION
APPOINTMENT OF DIVISIONAL CHEMIST

APPLICATIONS are invited from suitably qualified persons for the position of DIVISIONAL CHEMIST in the Lincolnshire Division. The post is graded APT. 10/12 (£860/£1,070), and the commencing salary will be within that range commensurate with the qualifications and experience of the person appointed.

Candidates should preferably hold a degree in chemistry or equivalent qualification and have considerable experience of chemical control in gas works.

The successful applicant will be based at Lincoln and will be responsible to the Divisional Engineer for ensuring uniformity of the chemical control at all manufacturing stations throughout the Division, additionally he will give direct supervision to the chemical control at the Lincoln Gas Works.

The position is pensionable and the successful applicant will be required to pass a medical examination.

Applications, giving details of education, qualifications and experience, together with the names of two referees, should be addressed to reach the undersigned by not later than July 20, 1957.

BERNARD CLARKE,
Divisional General Manager.

Belle Vue House,
Carline Road,
Lincoln.

June 22, 1957.

PHILBLACK LTD., Carbon Black Manufacturers, invite applications from men with Graduate or similar qualifications (preferably in Chemical Engineering) for a position in their Process Engineering Department. Candidates should have some experience of heavy chemical, petroleum refining, or gas works plant, and should be prepared to undertake a variety of Plant Investigation and Process Development duties. This position arises from the continued expansion of the Company and will appeal to an able and alert man keen to progress with an actively growing concern. There is a contributory pension scheme and the minimum starting salary will be £900 p.a. Applications giving full details of experience, qualifications and age should be marked "Confidential" and addressed to: General Works Manager, Philblack Ltd., Avonmouth Docks Estate, Avonmouth, Bristol.

DEVELOPMENT ENGINEER required by Philblack, Limited. This rapidly expanding company requires a mechanical engineer to assist in the design and improvement of plant. This position will satisfy an alert man capable of working on own initiative and keen to progress. Applicants should possess a B.Sc. degree in engineering, or Corporate Membership of a major institution, with suitable experience, not necessarily in plant construction or the carbon black industry. This is a permanent appointment with a starting salary of at least £900 p.a., depending on experience and qualifications. Contributory pension scheme. Apply stating age, experience, full qualifications, to Works Engineer, Philblack, Limited, Avonmouth Docks Estate, Avonmouth, Bristol.

NORTHERN GAS BOARD

TEES-SIDE DIVISION

APPLICATIONS are invited for the position of TECHNICAL ASSISTANT at the Hartlepool Unit of the Board, within Grades A.P.T. 7/8, £705/£825 per annum.

The appointment is for general duties, and experience in the handling of Coke Oven gas is preferred, but not essential.

Applications, stating age and experience should be received by the undersigned, not later than first post Friday, July 12, 1957.

JOHN W. PALLISTER,
Divisional General Manager.

Northern Gas Board,
Tees-Side Division,
G.P.O. Box No. 4,
Commercial Street,
Middlesbrough.

June 18, 1957.

NORTH THAMES GAS BOARD

CHEMISTS AND PHYSICISTS holding University degrees are required in the Laboratories at Watson House, Fulham, S.W.6, to undertake research work on the utilisation and design of domestic and industrial gas and coke appliances, particularly on cookers, water heaters, gas and coke fires, refrigerators, and industrial apparatus.

The Laboratories have recently been modernised and extended and are responsible for research work for the Gas Industry throughout the country.

The appointments will be permanent and pensionable and the starting salary will be within the range of £710-£940 per annum, according to age, qualifications and experience.

Applications should be sent to the Staff Controller, North Thames Gas Board, 30, Kensington Church Street, W.8, quoting reference 666/280 to reach him within ten days of the appearance of this advertisement.

NORTH WESTERN GAS BOARD

HEAD OFFICE—MANCHESTER
SENIOR TECHNICAL ASSISTANT—PHYSICAL TESTING LABORATORIES, BLOOM STREET, SALFORD

APPLICATIONS are invited for the above pensionable appointment at a commencing salary within Grade A.P.T. 7 (males £705/£785 p.a.; females £626/£785 p.a.) according to qualifications and experience.

The work of the laboratory is concerned with the domestic and commercial utilisation of gas and coke and the testing of appliances. Applicants should hold a degree in chemistry or physics or an equivalent qualification and have completed their military service. Experience in gas utilisation fuel technology would also be an advantage.

Detailed applications, giving the names of two referees, should reach the Secretary, N.W.G.B., 60, Whitworth Street, Manchester, 1, within 14 days.

NORTH EASTERN GAS BOARD

LEEDS GROUP
NEW WORTLEY WORKS
TECHNICAL ASSISTANT (WORKS)

APPLICATIONS are invited for the above position at a salary within Grade A.P.T. 5 (Provincial 'A') (£605-£685 per annum) of the Salary Scale agreed by the National Joint Council for Gas Staffs.

Applicants, who should have completed their National Service, should have practical knowledge and experience of the control of Gas Works Plant and Retort House Control, and also be able to carry out normal routine chemical tests. Experience of the operation and control of automatic C.W.G. Plant would be an advantage.

The successful candidate will be required to pass a medical examination and to join the Board's Staff Pension Scheme.

Applications giving details of age, experience, qualifications and training, should reach N. G. Appleyard, Esq., Group General Manager, North Eastern Gas Board, Leeds Group, Sweet Street West, Leeds, 11, by Saturday, July 10, 1957.

J. C. GARDNER,
Secretary.

NORTH EASTERN GAS BOARD

ELECTRICAL ENGINEER

APPLICATIONS are invited for the position of ELECTRICAL ENGINEER, under the Chief Engineer, at the Head Office of the Board at Leeds. Candidates must be Corporate Members of the Institution of Electrical Engineers with wide experience in the layout and installation of electrical equipment in works and factories. Experience in gasworks' electrical practice will be an advantage.

The duties will include responsibility for layouts and specifications of electrical equipment, for supervising contractors' installation work and for advising on maintenance work of electrical equipment.

The salary will be within Group D of the National Salaries Tables for Senior Gas Officers—£1,375 to £1,575 per annum.

The appointment is of a permanent nature and the successful candidate will be required to pass a medical examination and to join the Staff Pension Scheme.

Applicants should complete the official application form which may be obtained from, and must be returned to, the Chief Engineer, North Eastern Gas Board, Bridge Street, Leeds 2, not later than July 22, 1957.

J. C. GARDNER,
Secretary.

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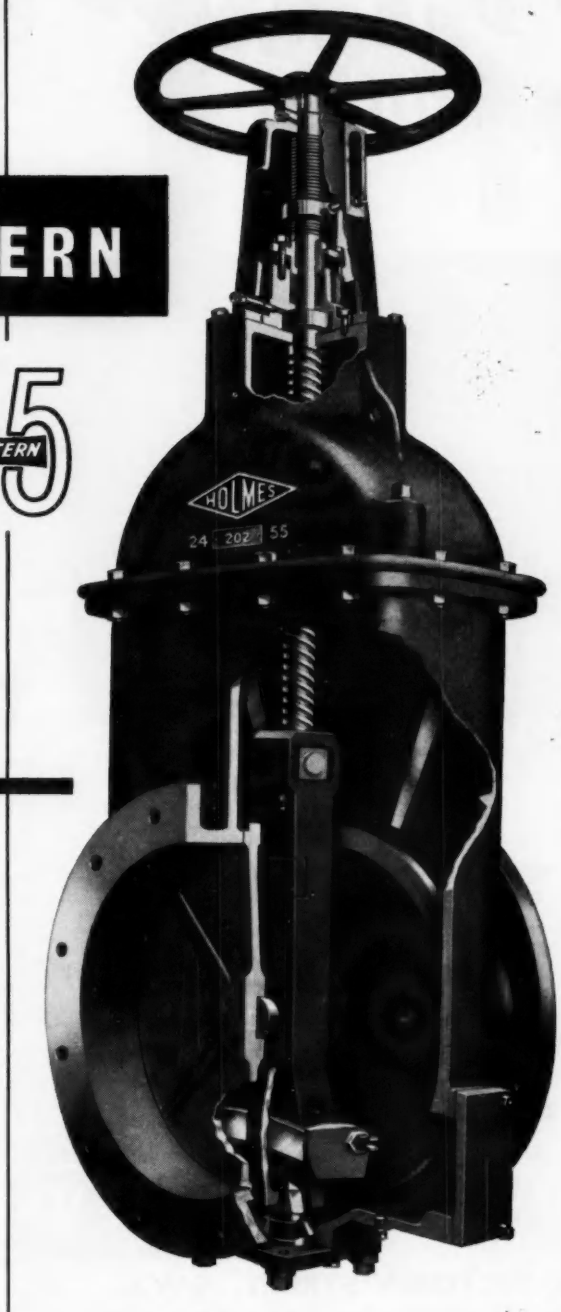

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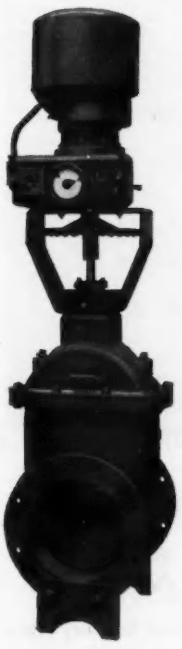

The illustration shows a 12" motorized Holmes-Western Valve.

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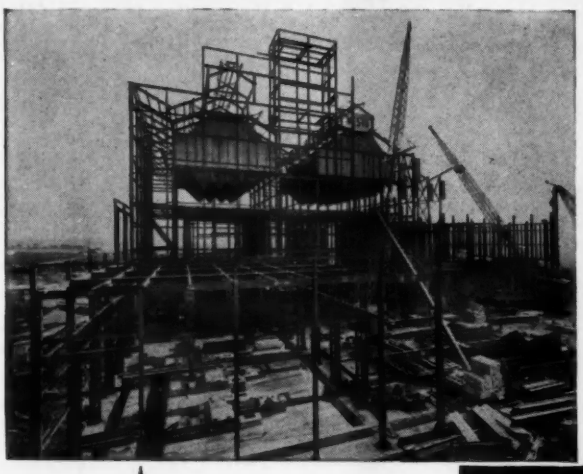

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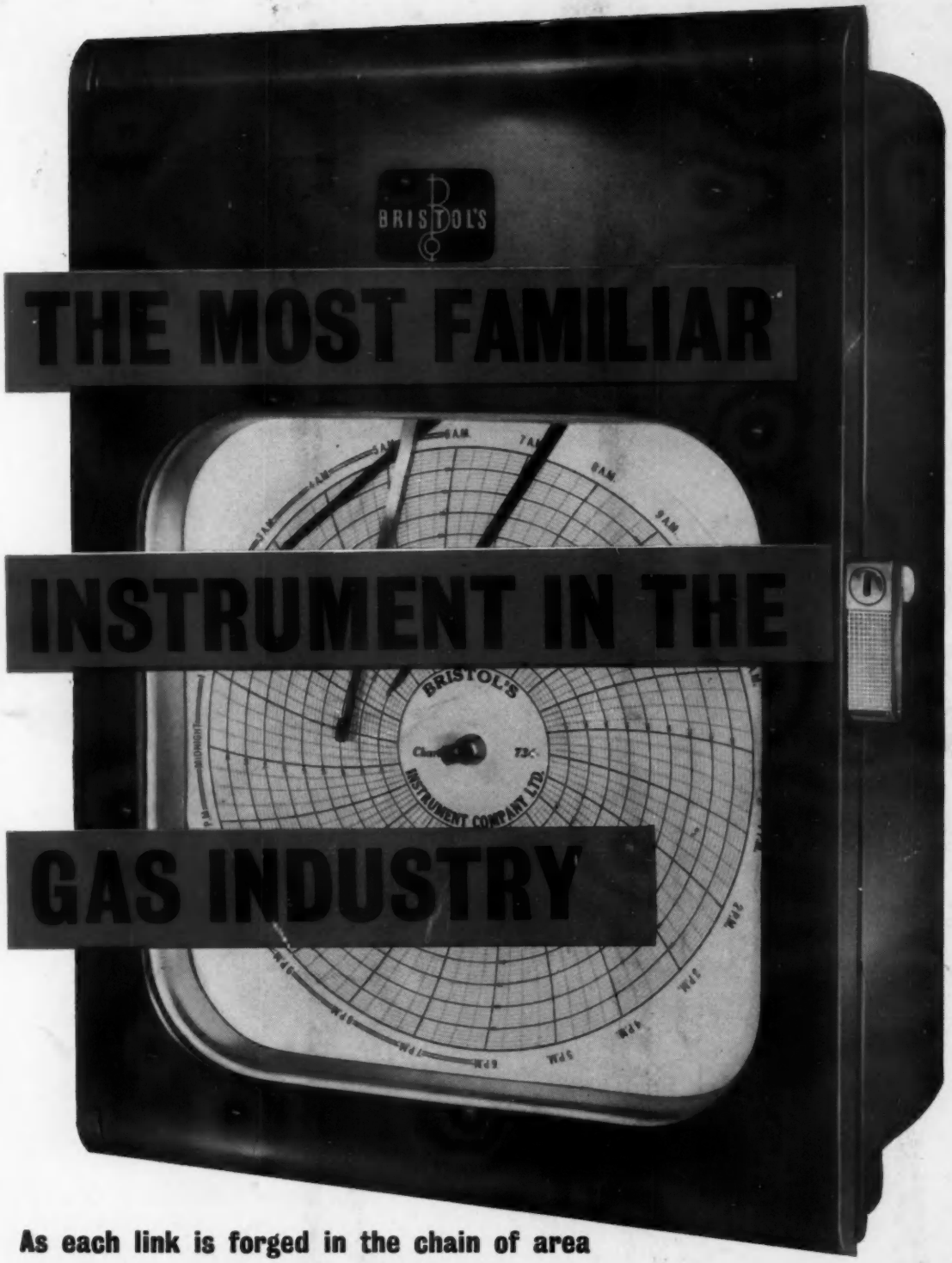

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